Table B-3. Average Trip Length (Minutes)

Type of Trip	2001		No-Build		Shared Solution	
	Davis Co.	Region	Davis Co.	Region	Davis Co.	Region
HBW (Home-Based Work)	20.11	20.17	21.47	20.58	19.50	20.20
HBC (Home-Based College)	27.50	16.66	29.14	17.32	27.29	17.22
HBO (Home-Based Other)	10.60	11.36	10.82	11.52	10.79	11.51
NHB (Non-Home-Based)	13.48	13.66	13.76	13.94	13.71	13.93
IX (Internal-to-External)	27.34	24.21	27.76	24.38	27.64	24.35
XI (External-to-Internal)	25.92	34.72	26.39	34.22	26.28	34.18
COMM (Commercial)	9.93	10.63	10.07	10.72	10.04	10.72
XX (External-to-External)	N.A.	45.19	N.A.	45.25	N.A.	45.15

Model Version 3.2 (Interplan 2004).

The current 2004 WFRC travel model (version 3.2) includes feedback loops that inform trip distribution of congested highway travel times resulting from assignment. As highway travel times increase due to congestion, trip distribution matches production TAZs to attraction TAZs that are closer together to maintain a reasonable pattern of trip lengths. This mechanism, along with mode choice, results in a varying total number of trips across any location, such as the Woods Cross screenline, that displays congestion.

This concept of varying distribution based on the feedback of traffic congestion resulting from the assignment step into the distribution step is one of the major improvements made by the WFRC to the travel model in recent years. Feedback from assignment to distribution was introduced into the WFRC model prior to the release of the Legacy Parkway Final EIS, but was not used in the Draft EIS. This is the reason that traffic volumes at the Woods Cross screenline were identical for all model alternatives in the Final EIS since no model feedback existed during the initial analysis. The concept of “unmet demand” was estimated from the model results, after the completion of the modeling, to estimate the number of passenger car equivalent trips that exceeded a level of service (LOS) D. Under the current WFRC model (version 3.2) as used in the Legacy Parkway Supplemental EIS, the number of passenger car equivalent trips across the Woods Cross screenline varies based on the congestion level of each alternative highway and transit network.

The feedback process used in the Legacy Parkway Supplemental EIS allows for speeds to become slower based on the effects of congestion which results in a different matching of origin and destination pairs which essentially removes trips from the Woods Cross screenline as congestion increases, but still matches those trip pairs to other (less congested) locations in the four county regional model. Although congestion begins at LOS D and becomes increasingly greater at worsening levels of service, the WFRC model does not prohibit trip pairs across the Woods Cross screenline based on congestion; it simply allows for the affects of congestion to alter the location and mode of a fixed number of trips (estimated in the WFRC model trip generation step).

Because the current WFRC model alters location and mode of trips in response to congestion, the Supplemental EIS no longer uses the concept of “unmet demand” which was used in the Final EIS. The concept of “unmet demand” was used in the Final EIS to compare projected travel demand against the capacity of future transportation systems. Changes in the WFRC model now vary total demand in direct response to the capacities of the transportation system, making the concept of “unmet demand” less useful for the Supplemental EIS.

The varying of total demand is accounted for in both the distribution step of the WFRC model and the mode choice step of the WFRC model. Varying demand could be described in terms of “suppressed demand” or, its converse, “induced demand.” The terms describe opposite perspectives of the same phenomenon: as transportation system capacity is improved, additional trips make use of the enhanced capacity. Such trips can be viewed as suppressed demand: trips that would have been taken initially had the system offered sufficient mobility. Alternatively, they can be viewed as induced demand: trips that the traveling public finds attractive because mobility has been improved. The capacity-enhancing elements of the Shared Solution may result in demand levels increasing compared to the No-Build Alternative due to potential shifts in route or mode in the North Corridor. This is travel demand that would be “suppressed,” or not accommodated under the No-Build Alternative, but that would be accommodated under the Shared Solution. For the purposes of this study, demand accommodated under the Build alternatives that would not be accommodated under the No-Build is referred to as “suppressed demand.”

B3.4.4 Suppressed Demand

The Final EIS used the concepts of “unmet demand” and “latent demand” to describe the effects of traffic capacity and congestion on travel demand. Changes in the WFRC model make using the “unmet demand” concept less useful for the Supplemental EIS for three reasons. First, the overall level of 2020 travel demand in the corridor is lower than in the Final EIS due to updates to the WFRC socio-economic forecasts. Second, the current WFRC model varies total demand depending upon the capacities of the transportation system, and alters location and mode of trips in response to congestion. As a result, the model better reflects typical traveler behavior and allows trips to be redistributed to other destinations or modes of travel rather than defining the demand as unmet. Third, the analysis now recognizes demand in excess of capacity in terms of worsening degrees of LOS F congestion and further reduced traffic speeds and associated impacts, rather than simply in terms of unmet demand. Consequently, the Supplemental EIS no longer uses the concept of “unmet demand” used in the Final EIS.

The varying of total demand is accounted for in both the distribution step and the mode choice step of the WFRC model. Decreases and increases in demand in response to increasing or decreasing congestion described in terms of “suppressed demand” or, its converse, “induced demand.” The terms describe opposite perspectives of the same phenomena. As transportation service levels decline, the propensity to travel also reduces; trips become shorter or redirected, rely on alternate modes, or occur at less convenient times of day. As transportation system capacity is improved, some of the suppressed trips will be renewed, or induced, in response to the enhanced capacity. Those trips can be viewed as suppressed demand, reflecting trips that the traveling public would have taken had the capacity been there. Or they can be viewed as induced demand, or manifest latent demand, reflecting trips that the traveling public finds attractive because the capacity has been enhanced. To capture both mirror-image phenomena, this study uses the term “suppressed demand.”

The build alternatives would increase roadway capacity and reduce travel times in the north corridor. The reduction in travel time is analogous to a reduction in travel cost. In measuring this change, the most significant effect would be a potential shift in travel routes for some drivers and a potential shift in mode choice. Other travel demand effects such as increased trip generation or time of day shifts (including peak spreading), due to capacity increases do not have as significant effects for analyzing the Shared Solution. The WFRC model captures suppressed demand and incorporates it as a part of total projected demand.

Given the use of consistent land use assumptions in the analysis of all of the alternatives, the main variations in corridor travel demand from one alternative to the next relate to the different levels of accessibility and travel ease offered by the respective alternatives. Specific travel routes and modes used by the total travel demand model will be affected by the Shared Solution. The WFRC model forecasts these types of demand changes, projecting that generally less than 3% of the total travel demand reflects suppressed demand. The WFRC model was tested specifically for its sensitivity to these types of changes. In November 2003, UDOT completed an analysis of the elasticity of demand estimated with the WFRC travel models (version 2.1) to changes in capacity. These changes occur due to trip distribution, mode choice, and trip assignment steps of the model. According to UDOT's sensitivity analysis (Cambridge Systematics, November 2003, WFRC Model Sensitivity Study):

> *"Model elasticities fall within the expected range of expected range of acceptability based on comparisons with elasticity cited in a variety of research papers…Vehicle miles traveled generally increase with the addition of specific roadway projects while vehicle hours generally decreased."*

Figure B-1 displays the changes in the Woods Cross screenline volume with various alternatives to Legacy Parkway evaluated in the Supplemental EIS in the PM peak period. The use of the Woods Cross screenline and the use of the PM peak period are explained later in this memorandum. As shown, total screenline demand increases relative to increases in screenline capacity, from about 51,300 under the No-Build to about 52,600 with the Shared Solution. The route and mode shifts associated with suppressed travel from Legacy Parkway are measurable, although generally less than 3% of total screenline volume, and are accounted for in the WFRC travel model.

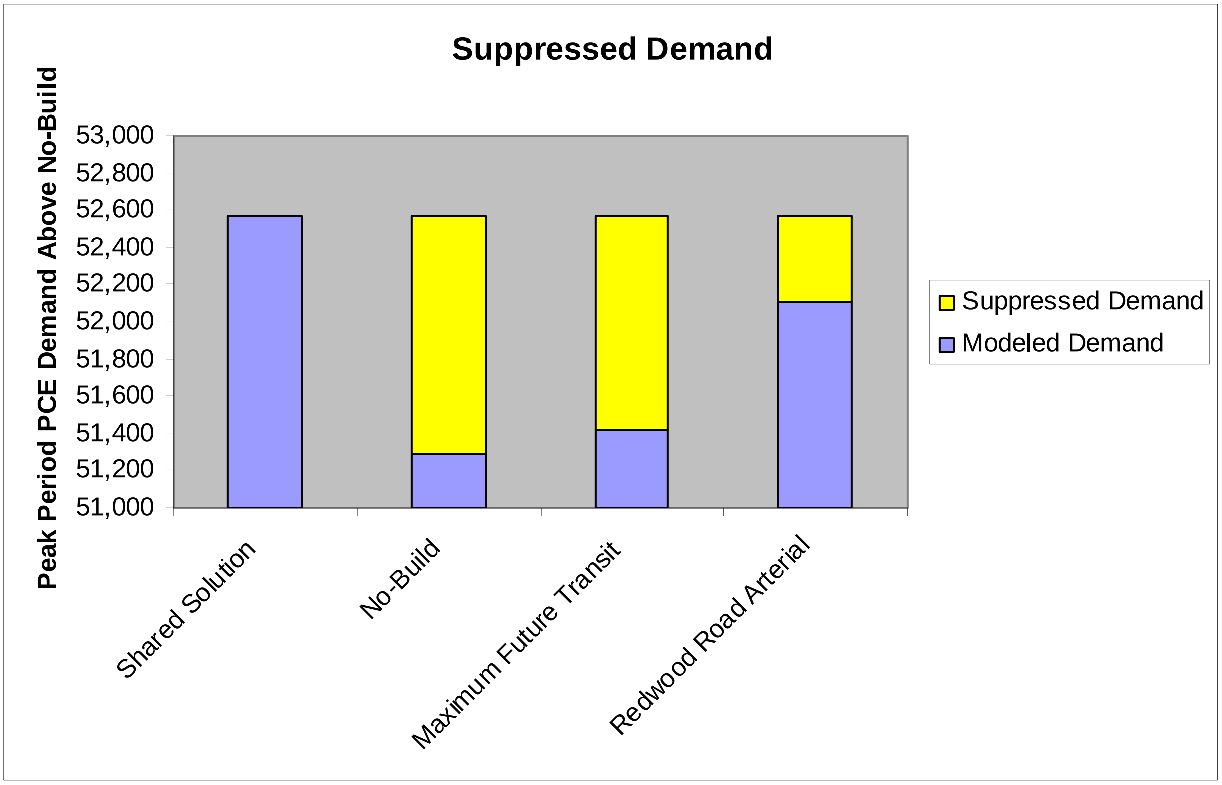
B3.5 Mode Choice

B3.5.1 Method of Mode Choice Analysis

Transit ridership forecasting methodologies used to prepare the Legacy Parkway Supplemental EIS differ from those used in the preparation of the Legacy Parkway Final EIS. While the WFRC model used for the Final EIS had a mode choice model, output of that model was evaluated but the results were not directly used in developing the mode specific traffic volume forecasts presented in the Final EIS. Instead, the concept of an extraordinary transit system was estimated based on an aggressive projection developed with UTA. Four methods were actually examined in the Final EIS including the use of the WFRC mode split step of the WFRC travel model, as well as experience in other areas. The Final EIS selected the highest transit capacity of the four methods not as a prediction of future transit ridership, but rather as a maximum level of transit ridership that could occur given the financial and other assumptions in the plan.

The recommendation of the lead federal agencies in the Legacy Parkway Supplemental EIS was to estimate transit ridership based on the mode split step of the regional travel demand model. Therefore, while the Final EIS included transit capacity as the maximum reduction of highway use that could be accommodated by the transit system, the Supplemental EIS uses the mode choice model to estimate the passenger-car equivalent demand of transit use. The modeling for the Supplemental EIS continued to use the WFRC mode choice step of the WFRC model, but with coding changes, as described in the Section B3.2.2 *Transit Network Assumption*, to account for a more "robust" level of transit supply.

Figure B-1. Peak Period Peak Direction Woods Cross Screenline Suppressed Demand



Source: WFRC travel model ver. 3.2 (Feb. 2004) as modified. Note: Total Demand includes transit vehicle equivalent ridership showing the full extent of Latent Demand through both the Distribution step and the mode choice step.

B3.5.2 Available Modes

Modal choice is the third step of the four-step travel demand modeling process. Productions and attractions of the trip generation module are linked in trip distribution, creating zone-to-zone person trip movements. These trips are then apportioned to the available travel modes through the application of the mode choice module.

The current WFRC mode choice module is calibrated to local data gathered for all modes that currently exist along the Wasatch Front as part of an on-board survey of transit riders conducted by UTA in 2002. The travel market that has mode choices available is segmented into four trip purposes; home-based work (HBW), home-based college (HBC), home-based other (HBO) and non-home-based (NHB). The trip purposes included in the mode choice analysis vary from the original trip generation and trip distribution purposes. Home-based college trips represent a sub-set of home-based other trips that have been found, through on-board surveys of the WFRC, to represent a reasonable portion of transit trips to estimate directly (as opposed to indirectly through home-based other trips). Commercial trips are generated as vehicle trips by definition, so no mode split component is necessary. Each trip purpose included in mode choice is also segmented in to three auto-ownership classes (zero-, one-, and two-car households) and two income classes (average/high and low) with the exception of non- home-based as by definition this purpose cannot be segmented by household data. As mentioned, HBC was subtracted from the HBO totals based on the data collected by each college and university. HBC is also a subset of Home-based school trips, which include high school and lower grades as originally reported in the 1993 Home Interview Survey.

An independent nested logit mode choice module exists for each trip purpose. These modules specifically address the following modes.

- Drive Alone: single-occupant auto trips.
- Shared Ride 2: double-occupancy auto trips.
- Shared Ride 3+: auto trips with three or more occupants.
- Transit - Walk to Local Bus.
- Transit - Walk to Express Bus.
- Transit - Walk to Light Rail.
- Transit - Walk to Commuter Rail.
- Transit - Drive to Local Bus.
- Transit - Drive to Express Bus.
- Transit - Drive to Light Rail.
- Transit - Drive to Commuter Rail.
- Walk trips.
- Bicycle trips.

Auto-occupancy for HBW, HBC, HBO and NHB trips is defined via mode choice before trips are assigned to the highway. This differs from the auto-occupancy methodology included in models used for the Legacy Parkway Final EIS. With the current model, trips are not assumed to occur in vehicles of fixed auto-occupancy, with a reduction to account for transit; rather all trips for HBW, HBC, HBO and NHB purposes choose (per the logit nesting structure) to make either a motorized or non-motorized trip. If the trip is motorized, it is either transit or auto-based. If an auto trip is chosen, it is either a single or multiple-occupant vehicle. If a multiple-occupant vehicle is chosen, it is either a two-person carpool, or a three- or more person carpool. Similar decision processes occur for the other modes. This description of the mode choice portion of the model applies to the modeling done for the Legacy Parkway Supplemental EIS, except in the coding of transit networks as described earlier in this memorandum.

B3.6 Peak-Period Trip Tables

In the updated WFRC regional travel demand model, peak-period trip tables are developed by applying factors, by purpose, to the daily person-trip tables. For example, the number of AM peak-period, home-based work trips are estimated as:

[daily HBW trips$_{ZONE}$ i,j) X (AM peak factor$_{HBW-P}$)] + [daily HBW trips$_{ZONE}$ j,i) X (AM peak factor$_{HBW-A}$)]

The AM and PM peak periods within the model have a three hour duration. The three hour forecast can therefore include trips that would spread from the peak one hour into the preceding, or following, shoulder hour and be accounted for in the peak period projection. The AM and PM peak-period factors were developed based on the 1993 Home Interview Survey. Table B-4 (Peak-Period Factors) shows the factors applied to each trip purpose to create the morning (AM) peak period and evening (PM) peak-period person-trip tables. Peak period factors are developed statically in the WFRC model, which means they do not change from the existing year to the future, and represent peak period demand as captured in the revealed (1993) data. Trip tables developed by WFRC were unchanged for the Legacy Parkway Supplemental EIS alternatives analysis.

Table B-4. Peak-Period Factors

	AM Peak Period	PM Peak Period
HBW – P	0.35	0.02
HBW – A	0.03	0.26
HBC – P	0.35	0.02
HBC – A	0.03	0.26
HBO – P	0.14	0.10
HBO – A	0.02	0.16
NHB	0.03	0.13
IX	0.02	0.22
XI	0.25	0.06
COMM	0.03	0.13

HBW - P = Home-based work trips—productions (commuters leaving homes and traveling to work)
HBW - A = Home-based work trips—attractions (work opportunities that attract travel by people)
HBC - P = Home-based college trips—productions (students leaving homes and traveling to college)
HBC - A = Home-based College trips—attractions (classrooms that attract college students)
HBO - P = Home-based other trips—productions (people leaving homes and traveling to places other than work)
HBO - A = Home-based other trips—attractions (places other than work that attract travel by people)
NHB = Non-home-based trips
IX/XI = Internal-external /external-internal
COMM = Commercial

Source: WFRC Travel Demand Model, February 2004.

B3.7 Highway Assignment

The highway assignment in the WFRC travel demand process is performed using a capacity- restrained, equilibrium-assignment technique. Capacity restraint is a general expression about the process of using congestion, and its impacts on travel time, as a means of simulating driver behavior under real-life conditions. All person trips that choose to travel in single occupancy vehicles, 2 person carpool or 3-plus person carpool in mode choice are factored to reflect the number of vehicles those trips would be made in (i.e., two-person carpool person trips, divided by two equals the number of vehicle trips).

Internal-to-external, external-to-internal, external-to-external and commercial trips are calculated in vehicle trips throughout the modeling process. Non-motorized and transit trips resulting from mode choice are not assigned to the highway network. Bus routing, which is irrespective of mode choice results, generally has an insignificant impact on highway assignment (in the range of four vehicle trips per hour for a high frequency bus route). Initially, all vehicle trips are assigned to paths with minimum travel times, based on free-flow travel speeds. After all trips are assigned, the volume on each link is compared to its capacity and the travel time impedance is adjusted, based on the volume-to-capacity ratio on that link. The assignment process is repeated with the adjusted travel times. In an equilibrium assignment, this process is repeated iteratively until all trips are traveling along the optimum path, based on specified closure criteria.

The resulting output from the highway assignment process is a “loaded” highway network containing link volumes and travel speeds based on the volume-to-capacity ratio of the link. Statistics on vehicle miles of travel and vehicles hours of travel are also reported.

For each alternative analyzed, highway assignments are performed for:

- AM peak period
- Mid-day period
- PM peak period
- Evening period

The assignment periods included in the travel model include multi-hour periods representative of various levels of congestion throughout the day, but large enough to capture the effects of peak spreading that may occur in the future. Specifically, both the AM and PM peak periods represent 3 hour periods supported by data from the 1993 Home Interview Survey which reflects the highest level of trip making and the potentially greatest traffic congestion. The PM peak period, used in subsequent peak hour analysis, includes the peak hour and two “shoulder” hours just before and after the highest peak hour.

The traffic volume forecasts for each portion of the day are summed to provide daily traffic volumes on each segment of highway modeled. The data from the AM and PM peak periods were factored to provide AM peak hour and PM peak hour traffic volumes, respectively. This process was completed for each of the alternatives analyzed. The Legacy Parkway Supplemental EIS modeling used the WFRC assignment portion of the travel model, with only the adjustments discussed previously being made to highway network coding to reflect the alternative being analyzed. Actual link impedance functions were recently re-calibrated by WFRC staff based on on-going speed data collection activities and described in the *Wasatch Front Regional Council Speed Study*, completed December 18, 2003 as an internal report by the WFRC staff. Impedance functions of the WFRC model are based on modifications of the original Bureau of Public Roads impedance functions as recommended in the *Highway Capacity Manual* (Transportation Research Board 2000) by functional road classification and as developed by WFRC to achieve base year (2001 and 2002) speed calibration.

B3.7.1 Average Daily Traffic Volume Forecasts

The Legacy Parkway Final EIS analyzed average daily traffic volumes for the North Corridor on a "screenline" basis. A screenline is an imaginary line through a travel corridor that crosses all generally parallel highways and roadways that carry traffic through that corridor. The screenline used was between 2600 South and 500 South (in Woods Cross). This screenline location was selected for use in the Final EIS because it carried the greatest traffic volume, was central to the Legacy Parkway and I-15 North Corridor study areas, and was considered to indicate the share of traffic that is expected to be carried by each of the roadway facilities for each alternative.

The same approach was used for the Supplemental EIS. Table B-5 (Traffic Volumes at Screenlines [2020]—Average Daily) shows the average daily traffic volumes along the roadway segments within the screenlines, and the total forecast volume across the screenlines for the no-build and build Legacy Parkway alternatives as determined by current forecasting methods. Although only northbound volumes are reported, both northbound and southbound volumes are included in the total.

Table B-5. Traffic Volumes At Woods Cross Screenline (2020)—Average Daily

	No Build		Shared Solution	
South of 500 South:	Northbound	Total	Northbound	Total
Legacy Parkway	0	0	35,100	71,900
Redwood Road	9,100	18,100	5,900	11,900
1100 West	1,000	1,500	500	600
800 West	4,300	8,400	4,200	8,000
I-15	110,200	221,000	86,300	171,300
U.S. 89	11,300	24,200	9,400	18,800
500 West	2,200	2,700	500	1,100
Orchard Road	5,900	11,600	5,100	10,500
Davis Boulevard	3,700	7,500	3,600	7,200
Bountiful Blvd.	5,200	10,300	4,900	9,700
Screenline Total	152,900	305,300	155,500	311,000

Source: WFRC travel model ver. 3.2 (2004) as modified and run by InterPlan Co. Model data traffic volumes represent number of vehicles not converted to passenger-car equivalents and are rounded to the nearest hundred.

B3.7.2 Peak-Period Traffic Volumes

To estimate peak-period traffic in the region and within the North Corridor specifically, the peak- period trip tables were assigned to the highway networks for each alternative. The assignment process is consistent with the WFRC PM peak-period assignment, and was used as a basis for determining peak period demand in the Legacy Parkway Supplemental EIS. Analysis of peak- period conditions is important because peak-period travel tends to be more concentrated and, in most urbanized areas, has substantial directional imbalances (e.g., inbound traffic towards activity centers during the morning peak-period, and outbound, from activity centers towards residential areas, during the evening peak-period).

The peak-period assignments in the WFRC travel demand model represent 3-hour durations for the AM and PM peak periods. The screenline traffic volumes for these peak periods are shown in Table B-6a, Traffic Volumes at Screenlines (2020)—AM Peak-Period, and Table B-6b, Traffic Volumes at Screenlines (2020)—PM peak period.

B3.7.3 Selection of the Woods Cross Screenline

The Woods Cross Screenline was selected for analysis in the Final EIS. The use of this screenline in the Final EIS was developed after a thorough consideration of all sections of the corridor and based on traffic volumes on all facilities in the corridor. After consideration, Woods Cross was chosen as being a representative section where traffic volumes and subsequent demand were the highest.

Table B-6a. Traffic Volumes At Screenlines (2020)—AM Peak-Period

	No-Build		Shared Solution	
South of 500 South:	Northbound	Southbound	Northbound	Southbound
Legacy Parkway	0	0	4604	10158
Redwood Road	1331	2953	537	1402
1100 West	63	275	55	34
800 West	554	1122	551	890
I-15	13972	27613	10518	24127
U.S. 89	1554	4583	1572	1524
500 West	88	119	86	60
Orchard Road	532	1823	539	1600
Davis Boulevard	438	909	442	748
Bountiful Boulevard	502	1473	505	1235
Screenline Total	19,034	40,870	19,409	41,778

Source: WFRC travel model ver. 3.2 (Feb. 2004) as modified and run by InterPlan Co. Model data traffic volumes represent number of vehicles not converted to passenger-car equivalents and are shown in table.

Table B-6b. Traffic Volumes At Screenlines (2020)—PM Peak-Period

	No-Build		Shared Solution	
South of 500 South:	Northbound	Southbound	Northbound	Southbound
Legacy Parkway	0	0	10155	7721
Redwood Road	3730	2008	1783	1571
1100 West	678	150	194	32
800 West	1446	975	1347	889
I-15	31222	23420	28851	17997
U.S. 89	4556	3066	2606	2508

500 West	1680	179	134	173
Orchard Road	2420	1202	1597	1063
Davis Boulevard	1093	845	1082	808
Bountiful Boulevard	1998	1153	1729	1040
Screenline Total	48,823	33,078	49,478	33,802

Source: WFRC travel model ver. 3.2 (Feb. 2004) as modified and run by InterPlan Co. Model data traffic volumes represent number of vehicles not converted to passenger-car equivalents and are shown in table.

Selection of the Woods Cross Screenline for the Supplemental EIS was chosen primarily for consistency with the Final EIS and because it is representative of the corridor. However, a comparison of volumes at the Woods Cross Screenline was made against the Farmington Screenline, also presented in the Final EIS, to determine that the Woods Cross Screenline remained the point where the highest volumes were projected through the corridor. Table B-7 displays the total PM peak period traffic volume at both the Farmington Screenline and Woods Cross Screenline for existing (2001) conditions, the 2020 No Build, and the 2020 Shared Solution. All other alternatives fall within the range of the Shared Solution and No Build results.

Table B-7. PM Peak Period Highway Network Screenline Comparison

	Farmington Screenline		Woods Cross Screenline	
	Northbound	Total	Northbound	Total
Existing (2001)	25,082	40,015	34,933	56,821
No Build	37,725	61,045	48,823	81,821
Shared Solution	38,495	62,419	49,478	83,280

Source: WFRC model ver. 3.2 (Feb. 2004) as modified. Model data traffic volumes have not been adjusted.

B3.8 Vehicle-Miles and Vehicle-Hours of Travel (VMT and VHT)

Vehicle miles of travel can also be displayed as a result of the modeling analysis. Table B-8 includes the regional vehicle miles of travel for the No-Build and Shared Solution. This table updates a similar table (P-11) included in the Final EIS. It indicates that, even when measured at a regional scale, the Shared Solution reduces miles of travel by providing a more direct route for through traffic, and vehicle hours by reducing congestion. At a regional level average travel speeds improve by about 4% to 5% during peak travel periods.

Table B-8. Regional and Study Area Vehicle-Miles of Travel (VMT) and Vehicle-Hours of Travel (VHT) for 2020

	Regional		Study Area	
Period	No-Build	Shared Solution	No-Build	Shared Solution
Daily				
VMT	57,413,217	57,330,753	3,917,840	3,884,047
VHT	1,520,693	1,483,723	99,828	76,504

	Regional		Study Area	
Period	No-Build	Shared Solution	No-Build	Shared Solution
Speed (mph)	37.8	38.6	39.2	50.8
AM Peak Period				
VMT	11,034,276	11,002,139	766,855	764,030
VHT	288,510	277,358	21,619	14,923
Speed (mph)	38.2	39.7	35.5	51.2
PM Peak Period				
VMT	15,469,820	15,449,640	1,053,417	1,043,053
VHT	508,752	484,666	37,358	21,542
Speed (mph)	30.4	31.9	28.2	48.4

Note: WFRC Model (version 3.2) (Feb. 2004) as modified and run by InterPlan Co.

Regional totals included the four county area (Salt Lake, Utah, Davis, and Weber Counties) included in the model, study area is medium district 10 with VMT and VHT totals excluding centroid connectors.

B4 Post-Model Adjustments

Processing of model outputs are more commonly referred to as "post model adjustments." Post model adjustments can be undertaken to "correct" model results, such as in the case of travel demand behavior that is not adequately addressed by the modeling process, or to allow the model outputs to be in consistent units necessary for capacity analysis. For the purpose of this section, any processing of model results that resulted in numbers that are not directly found as an output of the WFRC travel demand model, including model outputs resulting from the Legacy Parkway Supplemental EIS application of the WFRC travel demand model, as described, shall be termed a "post model adjustment." The Legacy Parkway Supplemental EIS modeling process employed both types of post model adjustments, those that result in a more accurate answer than those supplied by the travel model and/or those that are necessary to achieve results that can be analyzed using methods identified in the HCM 2000.

B4.1 Traffic Capacity Analysis

Traffic capacity analysis is a separate science than traffic forecasting, despite the fact that traffic forecasting requires some estimate of traffic capacity. On non-freeway road segments, traffic capacity is analyzed based on detailed signal timing and intersection movements at each intersection. This level of precision is unreasonable for 30-year forecasts of traffic as required for application in travel demand modeling. The travel demand model assumes generalized link based capacities to account for the detailed operations at each intersection.

Traffic capacity analysis is used to formalize and quantitatively compare the operation of two facilities. At its most simple level, traffic engineers must analyze even existing traffic counts to determine the various performance measures at each location, since the performance measures are typically not estimated directly from field observations. The HCM provides a standard means for objectively estimating the performance measures based on the collection of data such as traffic counts. The use of micro-simulation as a means of estimating performance measures based on collected (or forecast) traffic data is gaining popularity as an advanced practice in traffic capacity analysis, but does not replace the need to develop separate traffic forecasts that can then be applied to the traffic capacity analysis simulation model(s). At the national level, much research is being applied to merging the use of econometric travel demand models at the macro (regional) level with micro-simulated capacity analysis, but there are no metropolitan areas that presently use a single model for both macro level forecasting and micro level traffic capacity analysis.

B4.2 Model Adjustments

The Legacy Parkway Final EIS included an adjustment of demand to account for TSM/TDM/ITS as an after model analysis. A review of the adequacy of the model to capture and include relevant components of TSM/TDM/ITS for the Supplemental EIS was conducted as part of the analysis prepared for the Integration Technical Memo. As a result, primary elements of TSM/TDM/ITS are included in the current analysis through their inclusion in the new versions of WFRC travel demand model, or through in-model assumptions or post-model adjustments to capture the effects of the maximum future transit alternative developed for the Legacy Parkway Supplemental EIS. Several ITS and TSM measures are not included quantitatively in the analysis because they are primarily effective during traffic incidents rather than under the average weekday PM peak hour conditions addressed in the Supplemental EIS capacity and LOS analysis.

Table B-9 displays various TSM, TDM, and ITS components and identifies the manner in which they were addressed in the Legacy Parkway Supplemental EIS analysis, indicating those included in the travel model application, post model adjustments, or non-quantitative assessment of incident scenarios.

TSM is the acronym for Transportation Systems Management and generally refers to highway infrastructure optimization activities that do not require significant new infrastructure. Examples include ramp metering and reversible lanes. Since Legacy Parkway represents a new construction and I-15 is proposed to be reconstructed, the primary capacity enhancements associated with these facilities have been coded into the WFRC travel demand model by WFRC. The Supplemental EIS post-model analysis further refined the capacity analysis to incorporate relevant optimization associated with TSM operational improvements.

TDM is the acronym for travel demand management and includes a wide range of driver behavior related to avoiding peak travel periods or changing modes. Examples include parking pricing, carpool promotion and flex-time work hours. Most TDM elements are now incorporated in the utility functions of the WFRC mode choice model or captured in the calibration of the mode choice model to existing behavior. For example, the models reflect traveler response to parking prices and employer adoption and employee participation levels in telecommuting and variable work hours. The model extrapolates current trends associated with these factors into the future, allowing that any higher levels of adoption at large employers would be off-set by the overall trend towards smaller, more dispersed employment centers. ITS is the acronym for Intelligent Transportation Systems and includes a host of advancing technologies related to “smart cars” and “smart systems.” While it is difficult to predict future technologies, the primary focus of these technologies has been to provide better real time information to motorists in order to reduce the impacts of incidents and better utilize the available capacity. These applications are especially effective when capacity-reducing incidents occur, and when reasonable alternate travel routes are available. The quantitative capacity and Level of Service analysis performed for this Supplemental EIS addresses peak period conditions on a typical 2020 weekday, not conditions during major incidents. The benefits of information-based ITS elements are addressed through discussion of incident management issues in the corridor.

Because regional travel models such as the WFRC model do not focus in detail on neighborhood conditions, post-model adjustments are used to capture the TDM effects of land use clustering around transit stations, and localized density and land use mixing and associated with transit-oriented development (TOD). Therefore, the analysis of maximum future transit in the Supplemental EIS Integration analysis used post-model adjustments to increase transit, walk and bike shares and reduce automobile passenger car equivalents in the roadway capacity and LOS analysis. This accounted for sub-traffic zone level changes in land use to reflect TOD. For comparability, the increase in transit ridership was converted to transit “passenger car equivalents”, a calculated number of passenger cars that would otherwise be occupied by a number of transit riders.

B4.3 Model Adjustment for HCM Analysis

Various model adjustments were performed to allow the volume results reported in the travel model to be directly compared with methods included in the *Highway Capacity Manual*. These necessary adjustments include the following:

- Conversion of the 3-hour peak period to a peak hour,
- Heavy vehicle factor adjustments, and
- Peak-hour factor adjustments.

Each of the adjustments made were discussed amongst the Integration Analysis Technical Group upon review of data gathered locally. The Integration Analysis Technical Group included representation from FHWA, the Corps, UDOT, UTA, WFRC, and the consultant team.

B4.3.1 Peak Hour Conversion

Conversion from the PM peak period to the PM peak hour was made by applying a 0.36 factor. Since the PM peak period encompasses the peak three hours in the afternoon, the conversion from the peak period to the peak hour must be greater than 0.333. The review of traffic counts (Fehr & Peers 2004) indicated that the existing peak hour was 36% of the peak three hours. The Final EIS used a factor of 0.34 for the peak hour based on conditions at that time and assumptions regarding traffic leveling strategies for 2020. Discussions with WFRC model developers indicated that a 36% peak hour conversion from the peak period is now common through the model area. Further, assuming a 0.36 peak hour, the hours on either side of the peak would average 32% of the peak period. The hours on either side of the peak hour, within the modeled peak period were termed “the peak shoulder.” The peak-period factors shown in Table B-4 are used to relate the peak-period to the daily volumes based on trip purposes, and thus do not directly correlate to the peak hour conversion. Although peak hour traffic volumes are reported in the Supplemental EIS based on the best available data of 36% of the peak period occurring in the peak hour, analysis of the project is based on the entire three-hour peak period. This methodology eliminates the range of peak hour percentages in the future from consideration in the project purpose and need or alternatives analysis.

Table B-9. TSM/TDM/ITS Review

Category	Technique	Analysis Considerations	Method of Incorporation in Modeling
TSM	Ramp Metering	Effects on highway segments between interchanges accounted for in lane capacity assumptions.	Reflected in post-model capacity analysis, by assuming dense uniform flow downstream of on-ramps.
ITS	Variable Message Signs	SEIS capacity analysis represents conditions on days when no incidents occur. Variable message signs would help mitigate incident effects on days when they do occur, but would not make conditions better than incident-free days.	Addressed in discussion of need for alternate route to respond to incident and emergency needs, not in quantitative analysis of average-day conditions.
ITS	On-Board Navigation	SEIS capacity analysis represents conditions on days when no incidents occur. On board navigation would help mitigate incident effects on days when they do occur, but would not make conditions better than incident-free days.	Addressed in discussion of need for alternate route to respond to incident and emergency needs, not in quantitative analysis of average-day conditions.
TSM	Incident Management	SEIS capacity analysis represents conditions on days when no incidents occur. Incident management would help mitigate incident effects on days when they do occur, but would not make conditions better than incident-free days.	Addressed in discussion of need for alternate route to respond to incident and emergency needs, not in quantitative analysis of average- day conditions.
TSM	Auxiliary Lanes	Auxiliary lanes specifically accounted for in highway segment capacity analysis.	Accounted for in model highway networks and in post-model capacity analysis
TDM	Transit Promotion	Transit fare discounts and other TDM accounted for in modeling and off-model adjustments.	Accounted for in model transit networks and operating parameters, including fare structure and transit frequencies.
TDM	Carpool Promotion	Current levels of promotion, along with parking pricing and carpool lanes accounted for in modeling.	Accounted for in model networks and operating characteristics, including presence of HOV lanes and parking pricing.
TDM	Variable Work Hours	Existing rate captured in model calibration.	Variable work arrival/departure times accounted for in post-model analysis of demand spread over three-hour peak period.
TDM	Telecommuting	Existing rate captured in model calibration.	Existing levels of telecommute adoption accounted for in model trip generation rates for different employment types and trip purposes.
TSM	Signal Coordination	Arterial capacity assumptions used in analysis assume reasonable levels of signal coordination.	Accounted for in model network capacities and post-model capacity analysis.
TSM	Dynamic Signal Systems	Arterial capacity assumptions used in analysis assume reasonable achievable levels of dynamic traffic signal management.	Accounted for in model network capacities and post-model capacity analysis.
TDM	Truck Restrictions	Effects of trucks included in capacity analysis through heavy vehicle factor.	Included in post-model capacity analysis.

Category	Technique	Analysis Considerations	Method of Incorporation in Modeling
TDM	Van Pool Incentives	Current levels of promotion, along with parking pricing and new HOV lanes accounted for in modeling.	Accounted for in model networks and operating characteristics, including presence of HOV lanes and parking pricing.
TDM	Transit Financial Incentives	Transit fare discounts included in modeling of Maximum Future Transit.	Modeling included reduction of premium transit fares.
TDM	Parking Costs	Potential for increased parking cost included in modeling analysis.	Modeling included increased parking costs by 50% to 100% above inflation-based increase.
TDM	HOV Lanes	HOV lanes accounted for in modeling and in post-model analysis of assigning traffic to each lane.	Accounted for in modeling and in post-model analysis of lane utilization and capacity.
TSM	HOT Lanes*	Strategy not considered.	Not assumed in modeling.
TDM	Park and Ride Construction	Included in modeling.	Included in transit access mode coding within model.
TSM	Peak Spreading	Accounted for through averaging of peak-period demand over three-hour period.	Model estimates peak-period demand as a percentage of daily. Post-model capacity analysis addressed traffic spread over the three-hour peak period rather than concentrated in a single peak hour.
TSM	Reversible Lanes	Included in modeling (as appropriate to the alternative).	Accounted for in model networks and in post-model analysis of lane utilization and capacity.
TDM	Non-Motorized Travel	Post-model adjustments applied for scenarios that include higher levels of accommodation for bike and walk modes than presently found in similar areas of the region.	Empirical evidence on the reduction in auto travel resulting from increased development density, land use mix and urban design used to factor vehicle trips to lower levels than standard model trip generation rates.

* HOT lanes are high-occupancy toll lanes. Under this strategy, high-occupancy vehicle (HOV) lanes are made available to single-occupancy vehicles (SOV) at a price. Tolls are charged to SOV's based on time-of-day and level of congestion, so that the value of travel time savings correlates with the cost of toll.

Concern was raised about the accuracy of the peak hour considering the issues surrounding peak spreading. The WFRC model relies on a 3-hour peak period and the factoring of this period to a constrained hour would be arbitrary. This concern was expressed in the initial Supplemental EIS scoping meetings related to the greater ability of transit to serve a significant mode percentage in the peak hour and peak direction than in daily or peak period conditions. Transit and highways are estimated based on consistent factors from the peak hour to the peak period and presents a useful comparison of the maximum reasonable transit use over the peak period.

Capacity estimates expressed throughout this report, and used in the Supplemental EIS, based on peak period values are based on screening level capacities. These capacity estimates are supported by procedures in the *Highway Capacity Manual* but reflect average conditions over a peak period. Micro simulation capacity analysis is rapidly gaining acceptance in the traffic engineering community and represents a preferred method of detailed capacity analysis after screening. Micro simulation results will not vary from the screening results over the peak period, but will allow for a more meaningful display of the actual peaks based on the abilities traffic queues to build and dissipate over time based on a simulation of the true variation of traffic flow.

B4.3.2 Heavy Vehicle Factor

Capacity analysis for freeways as per the methods of the *Highway Capacity Manual* (HCM) (Transportation Research Board 2000, Chapter 23, page 23-7) recommends the division of hourly volumes by a peak hour factor, a heavy vehicle factor, and a driver population factor to account for the percentage of large (heavy) vehicles using a freeway. These heavy vehicles affect traffic flow. These factors assume “level terrain” as defined by the HCM and do not apply to arterial streets. Table B-10 presents the truck data (Fehr & Peers 2004) that supports the use of a 0.99 Heavy Vehicle Factor.

Table B-10. Heavy Vehicle Adjustment Factor

Period	Percentage Heavy Vehicles	Heavy Vehicle Factor
Peak Hour	Average Over Hour	0.99
Peak Hour	Highest Percent in Hour	0.99
Peak 3 Hour Period	Average Over Period	0.98
Peak 3 Hour Period	Highest Percent In Period	0.98
Recommended 2020 Peak Hour		0.99

B4.3.3 Peak Hour Factor

Capacity and LOS analysis in the HCM normally addresses conditions in the peak 15-minutes of the peak hour of a typical or “design” day. UDOT’s objectives for the north corridor are to provide acceptable traffic LOS on average through the peak hour or three-hour peak period on a typical weekday. Other State Departments of Transportation, including Florida, Arizona, Colorado, and Oregon also suggest that LOS goals should apply over average extended periods of time rather than to all traffic over all time periods as short as 15 minutes. Based on scoping for the Supplemental EIS, UDOT has not utilized the most congested 15 minutes of the peak hour for the Legacy Parkway. Therefore, Level of Service Analysis presented for the Legacy Parkway reflects an average peak hour and average peak period condition.

B4.3.4 Driver Population Factor

A driver population factor of 1.0 was used to reflect the commuter nature of the area, as suggested in the HCM, 2000.

B4.3.5 HOV Analysis

Limited analysis of HOV lanes is presently supported by the WFRC travel demand model. Through both the distribution and assignment step of the WFRC travel model, the presence of HOV lanes is recognized by a decrease in available capacity necessary to ensure that the HOV lane operates at an improved level as compared to the general purpose lanes. A manual step is required to ensure that the assumed capacity of the HOV lane can be efficiently utilized with 2 or 3 person carpools. The HOV lane was coded to achieve a maximum capacity without congestion coded as 1680 passenger car equivalents per hour. The full use of this HOV lane was assumed to reduce the demand of other general purpose lanes, thereby allowing the HOV lane to achieve its desired policy affect of reducing anticipated congestion in the general purpose lanes by encouraging shifts in driver behavior.

B5 Supporting Results

Significant analysis was developed which aided in the understanding of each alternative to the Legacy Parkway. Some of the alternatives included in this write-up were addressed but not advanced in the Supplemental EIS. Although these alternatives were not advanced, it was the opinion of the lead federal agencies that full disclosure of all analysis was appropriate.

B5.1 Possible Land Use Shifts under No-Build Alternative

As discussed in land use topic in the Supplemental EIS Section 4.1.3.3 (*Impacts on Growth within and beyond the North Corridor),* approximately 800 acres of developable land would become available for development in North Salt Lake, Centerville, Farmington, Woods Cross, Bountiful, and West Bountiful if Legacy Parkway were not built. The land is located within the protected right-of-way for the Legacy Parkway, and within the proposed project-sponsored nature Preserve, generally west of existing and developing areas. Under the No-Build Alternative, UDOT would lack authority to keep the right-of-way or the Preserve; thus the land would be available for development. Based on a review of historic zoning and on interviews with planning staff with each City, an estimated 100 to 200 acres would be developed under residential uses at approximately five units per acre. The remainder of the 800 acres would develop under retail, commercial, business-park, warehouse and manufacturing use. City planning representatives also state that real estate market activity within their communities and the properties' strategic location within the region, near the airport and regional CBD suggest that the land would develop in the relatively near term, prior to 2020. The planners also believe that the development would represent net additional development within their communities rather than spreading the same amount of development that would otherwise occur at lower densities over larger areas.

There are no official assessments of the degree to which these changes in land availability might effect the officially adopted regional land use projections and city-by-city allocations prepared by the Utah Governor's Office of Planning and Budget and Wasatch Front Regional Council. The 800 additional acres represents a very small percentage of county wide and regional development over the study period. It is equivalent to less than 6% of the projected 2000 to 2020 regional growth within the Study Area (a 20-year total of about 14,000 acres at the rates projected by local planners in Section 4.1.2.1 *Current Land Use and Development Trends in the Study Area*), and about less than 1% of Wasatch Front four-county population growth. Considering the regional land supply, variations in economic conditions and land values and variable demand for specific types of use at specific locations, it is uncertain the extent to which the additional land will:

- reduce development densities within the corridor
- delay market absorption of certain corridor lands until beyond 2020
- slow some development in cities north of the North Corridor until beyond 2020
- shift development into the additional corridor lands from other parts of the region

It is unlikely that the small percentage increase in available land within the region will affect the amount of population or employment within the region. Therefore, the change will result in changes in development within the North Corridor cities ranging from:

- Negligible - if the consequences are primarily reduced development densities within the corridor and/or no increase in market absorption rates for corridor lands.

- Additional 800 acres of residential, commercial and industrial development – if densities remain unchanged and absorption rates increase. The additional development could amount to up to 500 additional dwelling units and up to 8,700 commercial and industrial employees within the developable areas of the right-of-way and Preserve.

If additional 800 acres do develop within the corridor by 2020, there would be an equivalent reduction in development elsewhere in the region. While no official projections have been performed, it is possible that some of the development shifted into the corridor would come from areas north of the corridor, including north Davis and Weber Counties. About 20% of the region's growth is predicted to occur in these areas; so on a simple proportional basis, about 20% of the development shifted into the corridor would be shifted from north Davis and Weber Counties. This would translate to 100 fewer dwelling units and 1,500 fewer employees in north Davis and Weber Counties than under the build alternatives. At the other extreme, 100% of the shift could come from north Davis and Weber Counties. In that case, reductions of 500 dwelling units and up to 8,700 commercial and industrial employees could occur in north Davis County, Ogden and Weber County, with the development instead shifted to the Legacy Parkway right-of-way and nature Preserve.

Under this assumption, the development shifted into south Davis County would generate about 9,500 additional peak period trips in south Davis (based on WFRC model trip generation rates) and reduce trip generation in north Davis and Weber Counties by a similar amount: up to 9,500 peak period trips. If the development were to remain located in north Davis and Weber Counties, the majority of the generated traffic would remain local and would not traversed I-15 through the North Corridor. WFRC model trip distribution and directional percentages indicate that removing 800 acres or 9,500 peak-period trips from north Davis and Weber Counties translates to a reduction of roughly 600 peak-period, peak-direction passenger-car equivalents (pces) on I-15 at the Woods Cross screenline. However, these pces would be more than fully replaced by pces added to I-15 by the new trips generated by the additional 800 additional acres of development within the Legacy Parkway right-of-way and preserve.

Based on the WFRC model, the additional 800 acres of development in the Legacy Parkway right-of-way and preserve would generate an additional 9,500 peak period trips in the western portions of the North Corridor communities. This traffic would circulate on new local streets built within the Legacy Parkway right-of-way and Preserve and on existing surface streets such as Redwood Road, 500 South and Parrish Lane, resulting in higher impacts on those streets than under the Build Alternative. According to WFRC model trip distribution and directional percentages, approximately 30% of the additional generated traffic would use I-15 in peak direction in the southern part of the North Corridor. This would more than off-set the reduced traffic from north Davis and Weber Counties. The net increase in pces in the peak period, peak direction at the Woods Cross screenline would be approximately 1,100 pces or about 4 to 5% of the total pces that I-15 is projected to carry in 2020. This increase would worsen the LOS, which even without the land use shift would be LOS F in 2020 under the No-Build Alternative.

Consequently, by not assuming development in the land occupied by the right of way and the Preserve, the land use assumptions used in this Supplemental EIS for the No-Build Alternative represent the low end of the range of the potential 2020 conditions on I-15 and a potentially favorable assessment of the potential traffic conditions on surface streets in western areas of North Corridor communities. On I-15 at the Woods Cross screenline, the land use shifts resulting from the additional 800 acres of developable North Corridor land in the No-Build Alternative would range from:

- An increase of 1,100 PM peak period peak direction pces (or 4%) above the traffic projected for the land use case analyzed in this Supplemental EIS, if the 800 acres of new corridor land use is drawn from development potential further north of the North Corridor.

- An increase of 1,500 PM peak period peak direction pces (or 5%) above the traffic projected for the land use case analyzed in this Supplemental EIS, if the new North Corridor land use is drawn from other parts of the region.

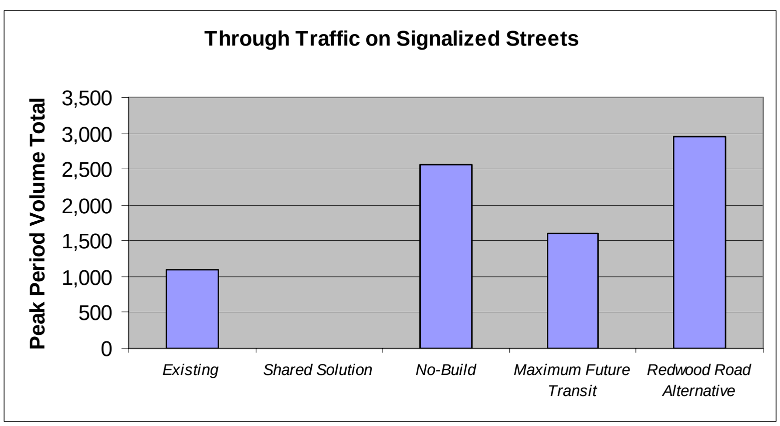
In both cases, the land use shift would worsen the 2020 LOS on I-15 at Woods Cross screenline to a worse LOS F than reported in Table 1-2 and Table 3-2 for the No-Build Alternative.

Also, in both cases, relinquishment of the land within the Legacy Parkway right-of-way and Preserve would increase traffic generation and local street construction in the western portions of North Salt Lake, Woods Cross, Centerville, Bountiful, West Bountiful and Farmington.

B5.2 Through Traffic on Local Streets

The travel model can identify traffic from various geographic origins and destinations. A useful analysis was to identify the component of traffic that had neither an origin nor a destination in the south Davis Study area. Traffic that passed through the study area but had neither an origin nor a destination in the area was termed “through” traffic. According to the AASHTO Green Book, traffic traveling distances or ten miles or more (i.e., through traffic) should be afforded high-speed facilities with some degree of access control. Accident rates collected by UDOT reveal that limited access facilities, those facilities which do not have traffic signals, have accident rates that are less than one third those of signalized streets. However, like travel times, there is no binary threshold which is readily accepted as a pass-fail criteria to screen alternatives. Figure B-2 displays that the Shared Solution can eliminate through traffic on signalized streets, representing a measure of safety of the North Corridor transportation system.

Figure B-2. Peak Period Peak Direction Through Traffic on Signalized Streets.



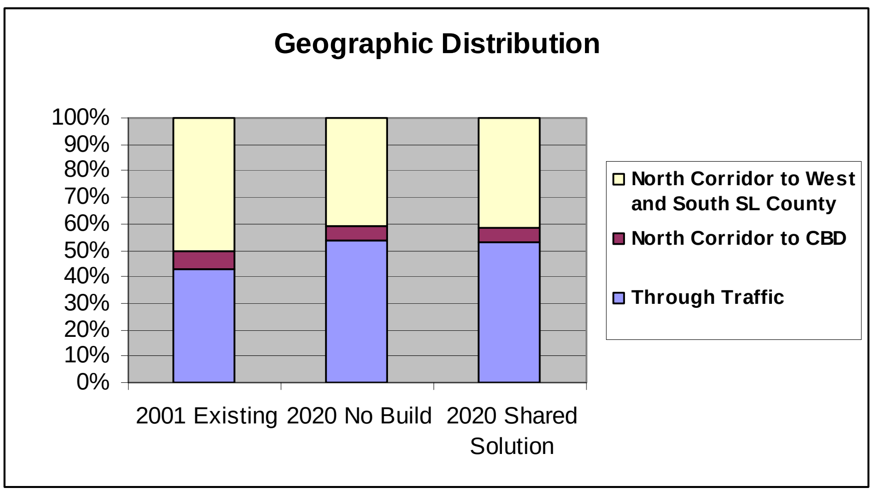
B.5.3 Geographic Travel Markets

The geographic market of travel across the Woods Cross screenline was examined in order to gain a deeper understanding of the travel demand in the North Corridor. The geographic markets were examined using the WFRC “City-X” script, which allows for the origin and destination traffic zone pairs of each trip to be identified. Three origin-destination pairs were identified as follows:

- Through traffic including all traffic with neither an origin nor destination in the North Corridor,
- CBD to and from North Corridor traffic, and
- Utah County and all of Salt Lake County outside of the CBD to and from the North Corridor.

The geographic distribution of total traffic generally follows the observed socio-economic trends of the area represented by a decline in the share of travel to and from the Salt Lake CBD and a corresponding growth of travel to and from north Davis and Weber County as well as south and west Salt Lake County. According to Figure B-3, travel from the CBD to the North Corridor is almost 7% of the total travel across the Woods Cross Screenline in 2001 but declines to approximately 5% in the year 2020. Through travel grows from less than 45% of the total travel across the Woods Cross screenline in 2001 to over 50% of the total travel in the year 2020. This 50% relates to all travel crossing the Woods Cross screenline on I-15 as well as surface streets. On I-15 itself, the through traffic percentage is higher: 65%. In the year 2020, changes in geographic travel markets can be observed between alternatives, but are generally very small such that each alternative in the year 2020 basically serves the same geographic market regardless of the construction of various facilities.

Figure B-3. Geographic Distribution of Total Travel across the Woods Cross Screenline.



In addition to the shift in the geographic markets over time from 2001 to 2020, another observation about the geographic travel markets is related to the use of each component of the Shared Solution in the year 2020, compared with facility-by-facility use under the No-Build Alternative. As shown in Figures B-4a and B-4b, each component of the Shared Solution serves a different set of travel markets. Under the Shared Solution, traffic on Legacy Parkway is made up almost entirely of through traffic and traffic to and from the North Corridor to western and southern Salt Lake County. By contrast, almost one quarter of travel demand using mass transit across the Woods Cross screenline is represented by the CBD to North Corridor geographic demand. The No-Build Alternative results in approximately 65% of the screenline demand on I-15 as through traffic, whose trips neither begin nor end in south Davis County. Due to the resulting congestion on I-15, the No-Build Alternative also produces approximately 15% of the travel on signalized arterial and collector streets as through traffic. This compares to the Shared Solution for which the additional capacity on the Legacy Parkway results in only 50% of the I-15 traffic to be through traffic, and no through traffic is served by signalized arterial and collector streets at the Woods Cross screenline. Figures B-4a and B-4b display the relative geographic demand of each facility type in the peak period and peak direction based on passenger car equivalents in the year 2020 under the No-Build and Shared Solution, respectively.

Figure B-4a. Geographic Distribution of Each Facility in the 2020 No Build

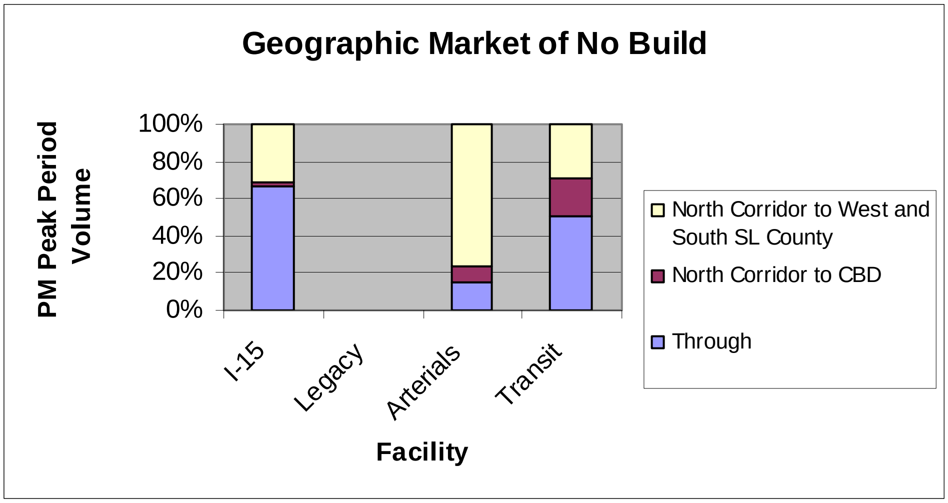
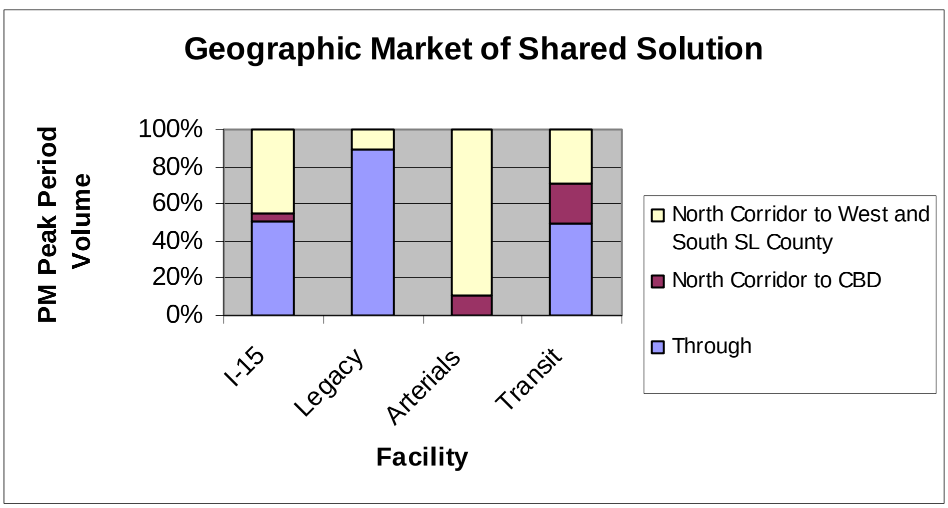


Figure B-4b. Geographic Distribution of Each Facility in the 2020 Shared Solution.



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Appendix C

Noise

<Organization?>
Curt Overcast

7 May 2004
TNM 2.1
Calculated with TNM 2.1

RESULTS: SOUND LEVELS

PROJECT/CONTRACT: Legacy Reevaluation
RUN: Pref.Alt - Revised Run (4/14/04)
BARRIER DESIGN: INPUT HEIGHTS

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

ATMOSPHERICS: 20 deg C, 50% RH

Receiver				No Barrier						With Barrier			
Name	No.	#DUs	Existing LAeq1h	LAeq1h		Increase over existing		Type Impact	Calculated LAeq1h	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc			Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
ML-1 (6 residences)	5	6	67.0	68.8	65	1.8	10	Snd Lvl	68.8	0.0	5	-5.0
ML-2 (7 residences)	6	7	53.0	54.4	65	1.4	10	----	54.4	0.0	5	-5.0
ML-3 (2 residences)	7	2	56.0	57.8	65	1.8	10	----	57.8	0.0	5	-5.0
ML-4 (Industrial/Commercial)	8	1	57.0	72.9	72	15.9	10	Both	72.9	0.0	5	-5.0
ML-5 (Vacant)	10	1	50.0	75.8	65	25.8	10	Both	75.8	0.0	5	-5.0
ML-6 (1 residence)	11	1	50.0	69.1	65	19.1	10	Both	69.1	0.0	5	-5.0
ML-7 (5 residences)	12	5	44.0	77.8	65	33.8	10	Both	77.8	0.0	5	-5.0
ML-8 (Bountiful Pond - Recreation)	13	1	46.0	78.2	65	32.2	10	Both	78.2	0.0	5	-5.0
ML-9 (6 residences)	14	6	41.0	74.0	65	33.0	10	Both	74.0	0.0	5	-5.0
ML-10 (3 residences)	15	3	48.0	74.6	65	26.6	10	Both	74.6	0.0	5	-5.0
ML-12 (3 residences)	16	3	60.0	72.4	65	12.4	10	Both	72.4	0.0	5	-5.0
ML-11(Undeveloped)	17	1	57.0	69.2	65	12.2	10	Both	69.2	0.0	5	-5.0
ML-13 (Glovers Park - Recreation)	18	1	56.0	64.7	65	8.7	10	----	64.7	0.0	5	-5.0
ML-14 (6 residences)	19	6	62.0	70.6	65	8.6	10	Snd Lvl	70.6	0.0	5	-5.0
ML-15 (12 residences)	20	12	44.0	0.0	65	0.0	10	inactive	0.0	0.0	5	0.0
ML-16 (6 residences)	21	6	58.0	0.0	65	0.0	10	inactive	0.0	0.0	5	0.0
ML-17 (8 residences)	22	8	49.0	0.0	65	0.0	10	inactive	0.0	0.0	5	0.0
R-1 (7 residences)	23	7	54.0	53.6	65	-0.4	10	----	53.6	0.0	5	-5.0
R-2 (3 residences)	24	3	54.0	52.8	65	-1.2	10	----	52.8	0.0	5	-5.0
R-3 (3 residences - Foxboro Dev.)	25	3	47.0	73.2	65	26.2	10	Both	73.2	0.0	5	-5.0
R-4 (3 residences - Foxboro Dev.)	26	3	48.0	72.6	65	24.6	10	Both	72.6	0.0	5	-5.0
R-5 (3 residences - Foxboro Dev.)	27	3	52.0	72.3	65	20.3	10	Both	72.3	0.0	5	-5.0
R-6 (3 residences - Foxboro Dev.)	28	3	43.0	67.7	65	24.7	10	Both	67.7	0.0	5	-5.0

RESULTS: SOUND LEVELS **Legacy Reevaluation**

R-7 (3 residences - Foxboro Dev.)	29	3	43 0	67.5	65	24.5	10	Both	67.5	0.0	5	-5.0
R-8 (3 residences - Foxboro Dev.)	30	3	44.0	67.2	65	23.2	10	Both	67.2	0.0	5	-5.0
R-9 (2 residences)	31	2	45.0	66.9	65	21.9	10	Both	66.9	0.0	5	-5.0
R-10 (3 residences)	32	3	40.0	65.9	65	25.9	10	Both	65.9	0.0	5	-5.0
R-11 (2 residences)	33	2	40.0	64.9	65	24.9	10	Sub'l Inc	64.9	0.0	5	-5.0
R-12 (2 residences)	34	2	39.0	64.0	65	25.0	10	Sub'l Inc	64.0	0.0	5	-5.0
R-13 (3 residences)	35	3	40.0	64.8	65	24.8	10	Sub'l Inc	64.8	0.0	5	-5.0
R-14 (2 residences)	36	2	40.0	65.6	65	25.6	10	Both	65.6	0.0	5	-5.0
R-15 (3 residences)	37	3	38.0	63.1	65	25.1	10	Sub'l Inc	63.1	0.0	5	-5.0
R-16 (2 residences)	38	2	39.0	64.0	65	25.0	10	Sub'l Inc	64.0	0.0	5	-5.0
R-17 (2 residences)	39	2	41.0	65.6	65	24.6	10	Both	65.6	0.0	5	-5.0
R-18 (2 residences)	40	2	41.0	66.9	65	25.9	10	Both	66.9	0.0	5	-5.0
R-19 (1 residence)	41	1	53.0	0.0	65	0.0	10	inactive	0.0	0.0	5	0.0
R-20 (1 residence)	42	1	50.0	0.0	65	0.0	10	inactive	0.0	0.0	5	0.0
R'-1 (Raceway at I-215)	43	1	50.0	0.0	65	0.0	10	inactive	0.0	0.0	5	0.0
R'-2 (Raceway at Parking Lot)	44	1	45.0	0.0	65	0.0	10	inactive	0.0	0.0	5	0.0
R'-3 (FBWMA - W. of Lake Bountiful)	45	1	40.0	0.0	65	0.0	10	inactive	0.0	0.0	5	0.0
R'-4 (FBWMA - Isolated Parcel)	46	1	61.0	0.0	65	0.0	10	inactive	0.0	0.0	5	0.0
Receiver47	47	1	44.0	0.0	65	0.0	10	inactive	0.0	0.0	5	0.0
Receiver48	48	1	44.0	0.0	65	0.0	10	inactive	0.0	0.0	5	0.0
Receiver49	49	1	44.0	0.0	65	0.0	10	inactive	0.0	0.0	5	0.0
Receiver50	50	1	44.0	0.0	65	0.0	10	inactive	0.0	0.0	5	0.0
Receiver51	51	1	44.0	0.0	65	0.0	10	inactive	0.0	0.0	5	0.0

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	132	0.0	0.0	0.0
All Impacted	75	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

<Organization?>
Curt Overcast

7 May 2004
TNM 2.1

INPUT: RECEIVERS
PROJECT/CONTRACT: Legacy Reevaluation
RUN: Pref.Alt - Revised Run (4/14/04)

Receiver												
Name	No.	#DUs	Coordinates (ground)			Height above Ground	Input Sound Levels and Criteria				Active in Calc.
			X	Y	Z		Existing LAeq1h	Impact Criteria		NR Goal	
								LAeq1h	Sub'l		
			m	m	m	m	dBA	dBA	dB	dB	
ML-1 (6 residences)	5	6	15,187.2	106,385.7	1,287.60	1.50	67.00	65	10.0	5.0	Y
ML-2 (7 residences)	6	7	14,914.1	107,383.9	1,289.52	1.50	53.00	65	10.0	5.0	Y
ML-3 (2 residences)	7	2	15,081.0	106,895.5	1,288.70	1.50	56.00	65	10.0	5.0	Y
ML-4 (Industrial/Commercial)	8	1	15,848.6	108,103.0	1,287.04	1.50	57.00	72	10.0	5.0	Y
ML-5 (Vacant)	10	1	15,675.7	109,805.1	1,289.57	1.50	50.00	65	10.0	5.0	Y
ML-6 (1 residence)	11	1	16,476.7	112,754.1	1,288.91	1.50	50.00	65	10.0	5.0	Y
ML-7 (5 residences)	12	5	17,053.1	114,665.5	1,288.78	1.50	44.00	65	10.0	5.0	Y
ML-8 (Bountiful Pond - Recreation)	13	1	17,538.6	115,078.1	1,287.20	1.50	46.00	65	10.0	5.0	Y
ML-9 (6 residences)	14	6	19,058.6	116,288.7	1,287.34	1.50	41.00	65	10.0	5.0	Y
ML-10 (3 residences)	15	3	18,562.1	115,993.6	1,287.85	1.50	48.00	65	10.0	5.0	Y
ML-12 (3 residences)	16	3	19,674.5	121,713.5	1,294.49	1.50	60.00	65	10.0	5.0	Y
ML-11(Undeveloped)	17	1	19,544.0	119,577.6	1,292.57	1.50	57.00	65	10.0	5.0	Y
ML-13 (Glovers Park - Recreation)	18	1	19,249.7	121,844.0	1,294.49	1.50	56.00	65	10.0	5.0	Y
ML-14 (6 residences)	19	6	19,358.9	122,784.5	1,296.52	1.50	62.00	65	10.0	5.0	Y
ML-15 (12 residences)	20	12	16,780.1	123,294.2	1,288.35	1.50	44.00	65	10.0	5.0	
ML-16 (6 residences)	21	6	16,819.5	124,884.0	1,290.13	1.50	58.00	65	10.0	5.0	
ML-17 (8 residences)	22	8	16,555.5	125,827.6	1,297.07	1.50	49.00	65	10.0	5.0	
R-1 (7 residences)	23	7	14,788.4	106,266.9	1,286.32	1.50	54.00	65	10.0	5.0	Y
R-2 (3 residences)	24	3	14,812.7	106,715.9	1,288.77	1.50	54.00	65	10.0	5.0	Y
R-3 (3 residences - Foxboro Dev.)	25	3	15,793.0	108,966.5	1,288.11	1.50	47.00	65	10.0	5.0	Y
R-4 (3 residences - Foxboro Dev.)	26	3	15,798.6	109,243.4	1,288.11	1.50	48.00	65	10.0	5.0	Y
R-5 (3 residences - Foxboro Dev.)	27	3	15,794.9	109,497.8	1,288.11	1.50	52.00	65	10.0	5.0	Y

INPUT: RECEIVERS

Legacy Reevaluation

R-6 (3 residences - Foxboro Dev.)	28	3	16,054.9	108,953.4	1,288.11	1.50	43.00	65	10.0	5.0	Y
R-7 (3 residences - Foxboro Dev.)	29	3	16,045.6	109,245.3	1,288.11	1.50	43.00	65	10.0	5.0	Y
R-8 (3 residences - Foxboro Dev.)	30	3	16,047.4	109,507.2	1,288.11	1.50	44.00	65	10.0	5.0	Y
R-9 (2 residences)	31	2	18,604.5	115,540.3	1,288.77	1.50	45.00	65	10.0	5.0	Y
R-10 (3 residences)	32	3	18,702.1	115,536.6	1,288.77	1.50	40.00	65	10.0	5.0	Y
R-11 (2 residences)	33	2	18,813.1	115,539.0	1,288.77	1.50	40.00	65	10.0	5.0	Y
R-12 (2 residences)	34	2	18,805.7	115,409.8	1,288.77	1.50	39.00	65	10.0	5.0	Y
R-13 (3 residences)	35	3	18,727.7	115,441.5	1,288.77	1.50	40.00	65	10.0	5.0	Y
R-14 (2 residences)	36	2	18,689.9	115,491.5	1,288.77	1.50	40.00	65	10.0	5.0	Y
R-15 (3 residences)	37	3	18,832.6	115,306.1	1,288.77	1.50	38.00	65	10.0	5.0	Y
R-16 (2 residences)	38	2	18,726.5	115,336.6	1,288.77	1.50	39.00	65	10.0	5.0	Y
R-17 (2 residences)	39	2	18,627.7	115,417.1	1,288.77	1.50	41.00	65	10.0	5.0	Y
R-18 (2 residences)	40	2	18,572.8	115,493.9	1,288.77	1.50	41.00	65	10.0	5.0	Y
R-19 (1 residence)	41	1	18,272.8	121,767.5	1,288.94	1.50	53.00	65	10.0	5.0	
R-20 (1 residence)	42	1	17,536.3	121,784.4	1,288.35	1.50	50.00	65	10.0	5.0	
R'-1 (Raceway at I-215)	43	1	15,410.0	106,527.6	1,287.60	1.50	50.00	65	10.0	5.0	
R'-2 (Raceway at Parking Lot)	44	1	15,508.2	106,390.2	1,287.60	1.50	45.00	65	10.0	5.0	
R'-3 (FBWMA - W. of Lake Bountiful)	45	1	16,715.7	115,338.9	1,288.78	1.50	40.00	65	10.0	5.0	
R'-4 (FBWMA - Isolated Parcel)	46	1	19,057.2	120,331.1	1,292.57	1.50	61.00	65	10.0	5.0	
Receiver47	47	1	16,928.5	114,667.5	1,288.00	1.50	44.00	65	10.0	5.0	
Receiver48	48	1	16,886.8	114,664.7	1,288.00	1.50	44.00	65	10.0	5.0	
Receiver49	49	1	16,851.9	114,665.8	1,288.00	1.50	44.00	65	10.0	5.0	
Receiver50	50	1	16,821.1	114,663.7	1,288.00	1.50	44.00	65	10.0	5.0	
Receiver51	51	1	16,966.3	114,668.5	1,288.00	1.50	44.00	65	10.0	5.0	

<Organization?>
Curt Overcast

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INPUT: ROADWAYS
PROJECT/CONTRACT: Legacy Reevaluation
RUN: Pref.Alt - Revised Run (4/14/04)

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with the approval of FHWA

Roadway		Points					Flow Control			Segment	
Name	Width	Name	No.	Coordinates (pavement) X	Y	Z	Control Device	Speed Constraint	Percent Vehicles Affected	Pvmt Type	On Struct?
	m			m	m	m		km/h	%		
Roadway 1 - Northbound	7.3	0	121	15,121.1	104,777.7	1,286.40				Average	
		1	122	15,105.7	105,653.9	1,288.60				Average	
		2	123	15,118.5	105,852.3	1,287.60				Average	
		3	124	15,172.7	106,080.4	1,286.30				Average	
		4	125	15,317.0	106,567.4	1,287.60				Average	
		5	126	15,398.1	106,736.2	1,288.20				Average	
		6	127	15,508.9	106,876.6	1,288.70				Average	
		7	128	15,608.2	106,999.0	1,289.20				Average	
		8	129	15,707.4	107,140.8	1,289.60				Average	
		9	130	15,766.6	107,294.1	1,289.50				Average	
		10	131	15,783.4	107,489.9	1,288.80				Average	
		11	132	15,703.5	107,876.5	1,287.20				Average	
		12	133	15,668.7	108,113.5	1,287.00				Average	
		13	134	15,551.5	110,166.1	1,289.60				Average	
		14	135	15,559.2	110,305.2	1,289.90				Average	
		15	136	15,612.0	110,467.6	1,289.70				Average	
		16	137	15,984.4	111,171.1	1,289.40				Average	
		17	138	16,037.2	111,305.1	1,289.70				Average	
		18	139	16,059.1	111,433.9	1,289.60				Average	
		19	140	16,136.4	112,928.5	1,288.90				Average	
		20	141	16,176.4	113,136.0	1,288.20				Average	
		21	142	16,347.7	113,647.5	1,287.40				Average	
		22	143	16,401.8	113,762.2	1,257.70				Average	
		23	144	16,474.0	113,866.5	1,287.70				Average	
		24	145	17,202.0	114,718.2	1,288.80				Average	

		25	146	17,348.9	114,841.9	1,288.40				Average	
		26	147	17,499.6	114,946.2	1,287.90				Average	
		27	148	17,660.7	115,091.8	1,287.20				Average	
		28	149	18,096.2	115,591.8	1,288.80				Average	
		29	150	18,214.7	115,746.4	1,288.90				Average	
		30	151	18,415.7	116,041.4	1,287.80				Average	
		31	152	18,533.0	116,156.1	1,287.40				Average	
		32	153	18,632.2	116,216.7	1,287.00				Average	
		33	154	18,954.3	116,375.1	1,287.30				Average	
		34	155	19,029.0	116,428.0	1,287.80				Average	
		35	156	19,124.4	116,516.9	1,288.40				Average	
		36	157	19,222.3	116,671.5	1,288.20				Average	
		37	158	19,268.7	116,814.5	1,287.40				Average	
		38	159	19,361.4	117,377.6	1,287.70				Average	
		39	160	19,397.5	117,503.8	1,287.70				Average	
		40	161	19,461.9	117,622.4	1,287.30				Average	
		41	162	19,732.5	117,950.9	1,287.30				Average	
		42	163	19,809.8	118,072.1	1,288.00				Average	
		43	164	19,856.2	118,200.9	1,288.50				Average	
		44	165	19,873.0	118,324.6	1,288.00				Average	
		45	166	19,888.4	121,611.5	1,292.70				Average	
		46	167	19,869.1	121,782.8	1,294.50				Average	
		53	168	19,458.1	123,196.3	1,296.50				Average	
		54	169	19,402.7	123,423.0	1,297.10				Average	
		55	170	19,346.0	123,553.2	1,301.80				Average	
		56	171	19,254.5	123,673.0	1,308.70				Average	
		57	172	19,187.5	123,763.2	1,311.20				Average	
		58	173	19,137.2	123,908.8	1,311.20				Average	
		59	174	19,112.8	124,116.2	1,310.50				Average	
		60	175	19,080.6	124,229.6	1,309.00				Average	
		61	176	19,007.1	124,345.6	1,304.90				Average	
		62	177	18,878.3	124,446.1	1,297.70				Average	
		63	178	18,734.0	124,505.3	1,295.60				Average	
		64	179	18,013.7	125,027.2	1,297.60				Average	
		65	180	17,464.8	125,512.9	1,303.70					
Roadway 2 - Southbound	7.3	0	181	15,105.5	104,778.7	1,286.40				Average	
		1	182	15,092.2	105,653.0	1,288.50				Average	
		2	183	15,105.5	105,853.0	1,287.40				Average	

		3	184	15,164.6	106,083.5	1,286.20				Average	
		4	185	15,309.3	106,567.3	1,287.60				Average	
		5	186	15,385.5	106,740.7	1,288.10				Average	
		6	187	15,492.2	106,891.2	1,288.70				Average	
		7	188	15,589.4	107,001.7	1,289.10				Average	
		8	189	15,694.1	107,148.3	1,289.60				Average	
		9	190	15,749.4	107,295.0	1,289.50				Average	
		10	191	15,768.4	107,489.3	1,288.80				Average	
		11	192	15,690.3	107,877.9	1,287.20				Average	
		12	193	15,656.0	108,114.1	1,287.00				Average	
		13	194	15,537.9	110,160.0	1,289.60				Average	
		14	195	15,547.5	110,304.7	1,289.80				Average	
		15	196	15,598.9	110,472.4	1,289.70				Average	
		16	197	15,968.4	111,163.8	1,289.40				Average	
		17	198	16,023.7	111,304.8	1,289.70				Average	
		18	199	16,046.5	111,440.0	1,289.60				Average	
		19	200	16,122.7	112,935.4	1,288.90				Average	
		20	201	16,164.6	113,143.0	1,288.20				Average	
		21	202	16,330.4	113,636.4	1,287.40				Average	
		22	203	16,389.4	113,765.9	1,287.70				Average	
		23	204	16,486.6	113,903.1	1,287.60				Average	
		24	205	17,193.3	114,726.0	1,288.80				Average	
		25	206	17,341.9	114,851.7	1,288.40				Average	
		26	207	17,488.5	114,960.3	1,287.90				Average	
		27	208	17,663.8	115,118.4	1,287.10				Average	
		28	209	18,058.1	115,569.8	1,288.60				Average	
		29	210	18,206.7	115,762.2	1,288.90				Average	
		30	211	18,399.1	116,044.1	1,287.90				Average	
		31	212	18,532.4	116,173.7	1,287.30				Average	
		32	213	18,625.7	116,230.8	1,287.00				Average	
		33	214	18,902.0	116,368.0	1,287.10				Average	
		34	215	19,006.7	116,427.0	1,287.70				Average	
		35	216	19,115.3	116,529.9	1,288.40				Average	
		36	217	19,214.4	116,684.2	1,288.20				Average	
		37	218	19,265.8	116,876.6	1,287.10				Average	
		38	219	19,343.9	117,381.4	1,287.70				Average	
		39	220	19,383.9	117,509.0	1,287.70				Average	
		40	221	19,446.7	117,627.1	1,287.30				Average	

		41	222	19,721.1	117,966.2	1,287.30				Average	
		42	223	19,795.3	118,078.6	1,288.00				Average	
		43	224	19,839.2	118,202.4	1,288.50				Average	
		44	225	19,852.5	118,326.2	1,288.00				Average	
		45	226	19,873.4	121,612.1	1,292.70				Average	
		46	227	19,850.6	121,777.8	1,294.50				Average	
		53	228	19,182.0	123,726.5	1,303.00				Average	
		54	229	19,138.2	123,819.9	1,307.60				Average	
		55	230	19,121.0	123,909.4	1,310.00				Average	
		56	231	19,096.2	124,073.2	1,310.10				Average	
		57	232	19,048.6	124,174.2	1,307.10				Average	
		58	233	18,970.5	124,258.0	1,301.70				Average	
		59	234	18,597.2	124,534.2	1,296.90				Average	
		60	235	18,000.9	125,008.5	1,297.70				Average	
		61	236	17,452.3	125,490.5	1,303.50					

<Organization?>
Curt Overcast

7 May 2004
TNM 2.1

INPUT: TRAFFIC FOR LAeq1h Volumes

PROJECT/CONTRACT: Legacy Reevaluation
RUN: Pref.Alt - Revised Run (4/14/04)

Roadway	Points		Segment									
Name	Name	No.	Autos		MTrucks		HTrucks		Buses		Motorcycles	
			V	S	V	S	V	S	V	S	V	S
			veh/hr	km/h	veh/hr	km/h	veh/hr	km/h	veh/hr	km/h	veh/hr	km/h
Roadway 1 - Northbound	0	121	3024	110	168	110	168	110	0	0	0	0
	1	122	3024	110	168	110	168	110	0	0	0	0
	2	123	3024	110	168	110	168	110	0	0	0	0
	3	124	3024	110	168	110	168	110	0	0	0	0
	4	125	3024	110	168	110	168	110	0	0	0	0
	5	126	3024	110	168	110	168	110	0	0	0	0
	6	127	3024	110	168	110	168	110	0	0	0	0
	7	128	3024	110	168	110	168	110	0	0	0	0
	8	129	3024	110	168	110	168	110	0	0	0	0
	9	130	3024	110	168	110	168	110	0	0	0	0
	10	131	3024	110	168	110	168	110	0	0	0	0
	11	132	3024	110	168	110	168	110	0	0	0	0
	12	133	3024	110	168	110	168	110	0	0	0	0
	13	134	3024	110	168	110	168	110	0	0	0	0
	14	135	3024	110	168	110	168	110	0	0	0	0
	15	136	3024	110	168	110	168	110	0	0	0	0
	16	137	3024	110	168	110	168	110	0	0	0	0
	17	138	3024	110	168	110	168	110	0	0	0	0
	18	139	3024	110	168	110	168	110	0	0	0	0
	19	140	3024	110	168	110	168	110	0	0	0	0
	20	141	3024	110	168	110	168	110	0	0	0	0
	21	142	3024	110	168	110	168	110	0	0	0	0
	22	143	3024	110	168	110	168	110	0	0	0	0

	23	144	3024	110	168	110	168	110	0	0	0	0
	24	145	3024	110	168	110	168	110	0	0	0	0
	25	146	3024	110	168	110	168	110	0	0	0	0
	26	147	3024	110	168	110	168	110	0	0	0	0
	27	148	3024	110	168	110	168	110	0	0	0	0
	28	149	3024	110	168	110	168	110	0	0	0	0
	29	150	3024	110	168	110	168	110	0	0	0	0
	30	151	3024	110	168	110	168	110	0	0	0	0
	31	152	3024	110	168	110	168	110	0	0	0	0
	32	153	3024	110	168	110	168	110	0	0	0	0
	33	154	3024	110	168	110	168	110	0	0	0	0
	34	155	3024	110	168	110	168	110	0	0	0	0
	35	156	3024	110	168	110	168	110	0	0	0	0
	36	157	3024	110	168	110	168	110	0	0	0	0
	37	158	3024	110	168	110	168	110	0	0	0	0
	38	159	3024	110	168	110	168	110	0	0	0	0
	39	160	3024	110	168	110	168	110	0	0	0	0
	40	161	3024	110	168	110	168	110	0	0	0	0
	41	162	3024	110	168	110	168	110	0	0	0	0
	42	163	3024	110	168	110	168	110	0	0	0	0
	43	164	3024	110	168	110	168	110	0	0	0	0
	44	165	3024	110	168	110	168	110	0	0	0	0
	45	166	3024	110	168	110	168	110	0	0	0	0
	46	167	3024	110	168	110	168	110	0	0	0	0
	53	168	3024	110	168	110	168	110	0	0	0	0
	54	169	3024	110	168	110	168	110	0	0	0	0
	55	170	3024	110	168	110	168	110	0	0	0	0
	56	171	3024	110	168	110	168	110	0	0	0	0
	57	172	3024	110	168	110	168	110	0	0	0	0
	58	173	3024	110	168	110	168	110	0	0	0	0
	59	174	3024	110	168	110	168	110	0	0	0	0
	60	175	3024	110	168	110	168	110	0	0	0	0
	61	176	3024	110	168	110	168	110	0	0	0	0
	62	177	3024	110	168	110	168	110	0	0	0	0
	63	178	3024	110	168	110	168	110	0	0	0	0

	64	179	3024	110	168	110	168	110	0	0	0	0
	65	180										
Roadway 2 - Southbound	0	181	3024	110	168	110	168	110	0	0	0	0
	1	182	3024	110	168	110	168	110	0	0	0	0
	2	183	3024	110	168	110	168	110	0	0	0	0
	3	184	3024	110	168	110	168	110	0	0	0	0
	4	185	3024	110	168	110	168	110	0	0	0	0
	5	186	3024	110	168	110	168	110	0	0	0	0
	6	187	3024	110	168	110	168	110	0	0	0	0
	7	188	3024	110	168	110	168	110	0	0	0	0
	8	189	3024	110	168	110	168	110	0	0	0	0
	9	190	3024	110	168	110	168	110	0	0	0	0
	10	191	3024	110	168	110	168	110	0	0	0	0
	11	192	3024	110	168	110	168	110	0	0	0	0
	12	193	3024	110	168	110	168	110	0	0	0	0
	13	194	3024	110	168	110	168	110	0	0	0	0
	14	195	3024	110	168	110	168	110	0	0	0	0
	15	196	3024	110	168	110	168	110	0	0	0	0
	16	197	3024	110	168	110	168	110	0	0	0	0
	17	198	3024	110	168	110	168	110	0	0	0	0
	18	199	3024	110	168	110	168	110	0	0	0	0
	19	200	3024	110	168	110	168	110	0	0	0	0
	20	201	3024	110	168	110	168	110	0	0	0	0
	21	202	3024	110	168	110	168	110	0	0	0	0
	22	203	3024	110	168	110	168	110	0	0	0	0
	23	204	3024	110	168	110	168	110	0	0	0	0
	24	205	3024	110	168	110	168	110	0	0	0	0
	25	206	3024	110	168	110	168	110	0	0	0	0
	26	207	3024	110	168	110	168	110	0	0	0	0
	27	208	3024	110	168	110	168	110	0	0	0	0
	28	209	3024	110	168	110	168	110	0	0	0	0
	29	210	3024	110	168	110	168	110	0	0	0	0
	30	211	3024	110	168	110	168	110	0	0	0	0
	31	212	3024	110	168	110	168	110	0	0	0	0
	32	213	3024	110	168	110	168	110	0	0	0	0

INPUT: TRAFFIC FOR LAeq1h Volumes | Legacy Reevaluation

	33	214	3024	110	168	110	168	110	0	0	0	0
	34	215	3024	110	168	110	168	110	0	0	0	0
	35	216	3024	110	168	110	168	110	0	0	0	0
	36	217	3024	110	168	110	168	110	0	0	0	0
	37	218	3024	110	168	110	168	110	0	0	0	0
	38	219	3024	110	168	110	168	110	0	0	0	0
	39	220	3024	110	168	110	168	110	0	0	0	0
	40	221	3024	110	168	110	168	110	0	0	0	0
	41	222	3024	110	168	110	168	110	0	0	0	0
	42	223	3024	110	168	110	168	110	0	0	0	0
	43	224	3024	110	168	110	168	110	0	0	0	0
	44	225	3024	110	168	110	168	110	0	0	0	0
	45	226	3024	110	168	110	168	110	0	0	0	0
	46	227	3024	110	168	110	168	110	0	0	0	0
	53	228	3024	110	168	110	168	110	0	0	0	0
	54	229	3024	110	168	110	168	110	0	0	0	0
	55	230	3024	110	168	110	168	110	0	0	0	0
	56	231	3024	110	168	110	168	110	0	0	0	0
	57	232	3024	110	168	110	168	110	0	0	0	0
	58	233	3024	110	168	110	168	110	0	0	0	0
	59	234	3024	110	168	110	168	110	0	0	0	0
	60	235	3024	110	168	110	168	110	0	0	0	0
	61	236										

Appendix D

Wetlands Functional Assessment

Appendix D

Wetlands Functional Assessment

This appendix presents supplemental information about wetland types in the study area and provides further clarification about how the wetlands functional assessment was performed, including the type of data used, the rationale for the approach to assessing indirect impacts on wetland functions, and the method for scaling the variables used in the assessment models. As a result, this section reiterates some of the information presented in the Final EIS to provide context for the supplemental information.

In addition, this appendix presents a series of tables illustrating indirect impacts on wetlands in the study area by hydrogeomorphic (HGM) wetland class and wetland cover type, as well as impacts on wetland functions for each wetland class and cover type.

D.1 Wetland Classes and Cover Types

The area of wetlands within the proposed build alternative rights-of-way and proposed Legacy Nature Preserve (Preserve) that would be subject to direct and indirect effects encompasses 987 ha (2,439 ac) of wetlands in three HGM wetland classes (depressional, groundwater slope, lacustrine fringe) and seven wetland cover types (forested wetland, shrub-scrub, marsh, wet meadow, playa, unconsolidated shore, and open water).

The Final EIS based all discussion of wetland functions, impacts, and mitigation on the three wetland classes. This document, however, separates wetland functions, impacts, and mitigation according to wetland cover types to provide additional ecological context by which to interpret the analysis. Table D-1, which updates and supplements Table 3-30 in the Final EIS, summarizes the quantities and functional ratings that make up these wetland classes and cover types.

Table D-1 Wetland Cover Types, Quantities, and Functional Ratings for Study Area

HGM Class	Wetland Cover Type	Quantity in Hectares (acres)*											
		Total		High		High-to-Medium		Medium		Medium-to-Low		Low	
Depressional	Forested Wetland	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)
Groundwater Slope		0.2	(0.4)	0.0	(0.0)	0.0	(0.0)	0.2	(0.4)	0.0	(0.0)	0.0	(0.0)
Lacustrine Fringe		0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)
Depressional	Shrub-Scrub	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)
Groundwater Slope		0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)
Lacustrine Fringe		1.4	(3.6)	0.0	(0.0)	1.4	(3.6)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)
Depressional	Marsh	14.5	(35.8)	0.7	(1.7)	5.5	(13.6)	8.0	(19.7)	0.3	(0.8)	0.0	(0.0)
Groundwater Slope		42.3	(104.5)	6.4	(15.8)	2.1	(5.3)	26.3	(64.9)	7.5	(18.5)	0.0	(0.0)
Lacustrine Fringe		233.2	(576.1)	0.0	(0.0)	206.3	(509.7)	26.9	(66.4)	0.0	(0.0)	0.0	(0.0)
Depressional	Wet Meadow	115.3	(284.9)	2.6	(6.5)	84.0	(207.6)	26.7	(66.0)	1.9	(4.8)	0.0	(0.0)
Groundwater Slope		152.4	(376.6)	80.8	(199.6)	18.2	(45.1)	48.9	(120.9)	4.5	(11.1)	0.0	(0.0)
Lacustrine Fringe		148.1	366.0	0.0	(0.0)	98.9	(244.5)	49.2	(121.5)	0.0	(0.0)	0.0	(0.0)
Depressional	Playa	46.4	(114.6)	3.5	(8.6)	31.3	(77.3)	10.5	(26.0)	0.0	(0.0)	1.1	(2.6)
Groundwater Slope		18.1	(44.7)	15.2	(37.6)	0.0	(0.0)	2.7	(6.6)	0.2	(0.4)	0.0	(0.0)
Lacustrine Fringe		124.5	(307.6)	0.0	(0.0)	99.7	(246.3)	24.8	(61.3)	0.0	(0.0)	0.0	(0.0)

HGM Class	Wetland Cover Type	Quantity in Hectares (acres)*											
		Total		High		High-to-Medium		Medium		Medium-to-Low		Low	
Depressional	Unconsolidated Shore	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)
Groundwater Slope		0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)
Lacustrine Fringe		38.9	(96.2)	0.0	(0.0)	36.5	(90.1)	2.5	(6.1)	0.0	(0.0)	0.0	(0.0)
Depressional	Open Water	2.5	(6.2)	0.0	(0.0)	1.4	(3.5)	1.1	(2.7)	0.0	(0.0)	0.0	(0.0)
Groundwater Slope		0.1	(0.2)	0.0	(0.0)	0.0	(0.0)	0.1	(0.2)	0.0	(0.0)	0.0	(0.0)
Lacustrine Fringe		49.4	(122.1)	0.0	(0.0)	25.1	(62.0)	24.3	(60.1)	0.0	(0.0)	0.0	(0.0)
Total		987.2	(2439.3)	109.2	(269.8)	610.5	(1508.5)	252.1	(622.9)	14.4	(35.5)	1.1	(2.6)

*Definitions defined below

Functional Rating	Average Functional Value
High	0.88 to 1.0
High-to-Medium	0.63 to 0.87
Medium	0.38 to 0.62
Medium-to-Low	0.18 to 0.37
Low	0.00 to 0.17

The following section presents information on the seven wetland cover types found in these wetland classed in the study area—forested wetland, shrub-scrub, marsh, wet meadow, playa, unconsolidated shore, and open water.

D.1.1 Marsh

Marsh is a wetland plant community characterized by tall, emergent, perennial, herbaceous monocots. Plant species most commonly observed in marsh within the study area include hard stem bulrush (*Scirpus acutus*), alkali bulrush (*Scirpus maritimus*), three square bulrush (*Scirpus americanus* and *Scirpus pungens*), cattail (*Typha latifolia*), creeping spikerush (*Eleocharis palustris*), reed canary grass (*Phalaris arundinacea*), common reed (*Phragmites australis*), blister buttercup (*Ranunculus sceleratus*), water buttercup (*Ranunculus aquatilis*), and Nebraska sedge (*Carex nebrascensis*). Marsh is the second most abundant wetland type in the study area. There are 290 ha (716 ac) of marsh in the study area, most of which is associated with the lacustrine fringe of Great Salt Lake.

The hydrology of the marsh cover type is provided by groundwater and/or surface water. Water covers the ground surface for long periods of time during the growing season. Depths can range from a few centimeters to almost a meter, but they are not deep enough to restrict the growth of emergent plant species. Areas where marsh is supported primarily by groundwater are typically located in depressions where the ground surface drops below the level of the water table. During the spring months, when the water table is high due to snowmelt and precipitation, these areas are inundated. As the level of the water table drops in the summer months, the marsh areas may no longer be inundated, although the soils remain saturated.

D.1.2 Wet Meadow

Wet meadow is a wetland plant community characterized by grasses and other low-growing, perennial monocots. Although the soil may be saturated for long durations, the vegetation is generally not emergent. Plant species most commonly observed in wet meadows in the study area include Baltic rush (*Juncus balticus*), creeping spikerush, clustered field sedge (*Carex praegracilis*), Nebraska sedge, rabbitfoot grass (*Polypogon monspeliensis*), foxtail barley (*Hordeum jubatum*), little barley (*Hordeum pusillum*), curly dock (*Rumex crispus*), and saltgrass (*Distichlis spicata*). Wet meadow is the most common wetland type in the study area. There are 416 ha (1028 ac) of wet meadow in the study area, distributed more or less evenly throughout all three HGM wetland classes.

The hydrology of the wet meadow cover type is provided primarily by groundwater, although surface water plays an important role in many of the areas. Wet meadow typically occurs in areas that are in close proximity to the water table. Early in the growing season the level of the water table may be higher than the ground surface, causing inundation. However, this inundation occurs less frequently and for a shorter duration than in marsh. Like marsh, wet meadows found in the study area typically occur in depressional wetlands, but unlike marsh, the water table level is just below to only slightly above the depression bottom. Because of this difference, wet meadows may be inundated only for brief periods, although the soils may be saturated at the surface for extended periods. As the water table drops in the summer months, the wet meadows become drier, and upland species may begin to grow by late summer.

D.1.3 Playa

Vegetation in the playa cover type is usually sparse, typically between 5 and 30 percent aerial cover. The vegetation is not uniformly distributed across the playas but tends to be concentrated around the margins. Typical species include western seepweed (*Suaeda occidentalis*), slender seepweed (*Suaeda depressa*), pickleweed (*Salicornia europaea*), saltgrass, iodinebush (*Allenrolfea occidentalis*), fat-hen saltbush (*Atriplex patula*), and Nuttall alkali grass (*Puccinellia nuttalliana*). Playa soils are extremely saline/alkaline, which suppresses the growth of most plant species. There are 189 ha (467 ac) of playa in the study area. About 66 percent of the playa habitat is associated with the lacustrine fringe of Great Salt Lake, and about 25 percent occurs in depressional wetlands.

The hydrology of playas in the study area is provided primarily by surface water. Playas are typically located in the lowest topographic positions of areas with internal drainage. They collect much of the runoff from adjacent areas following a precipitation event, and because of the high clay content of the soils, the water will pond. Following a precipitation event, playas may be inundated with several centimeters of water. Most of the standing water in playas is removed through evaporation, which deposits salts from the soils on the surface.

D.1.4 Scrub-Shrub

The scrub-shrub cover type is characterized by an overstory of woody shrubs, typically less than three meters in height. In some instances, this cover type is successional to forested wetlands. In the study area, the overstory of scrub-shrub wetlands is composed of tamarisk (*Tamarix ramosissima*), box-elder (*Acer negundo*), and/or coyote willow (*Salix exigua*). Understory plant species are similar to those found in wet meadow, including saltgrass, Baltic rush, common reed, reed canary grass, foxtail barley, and little barley. Only four small areas of scrub-shrub wetland are present in the study area, comprising 1.4 ha (3.6 ac).

The hydrology of scrub-shrub wetlands is provided by both surface and groundwater sources. Some of the scrub-shrub wetlands are adjacent to small streams, and their wetland hydrology is derived from the stream. Others are located in areas that are close to the water table and receive their moisture from groundwater.

D.1.5 Forested Wetland

The forested wetland cover type is characterized by an overstory of large trees. The overstory of this forested wetland is composed of narrow-leaf cottonwood (*Populus angustifolia*) and Russian olive (*Elaeagnus angustifolia*). The understory plant species is reed canary grass. Forested wetland is found at only one location in the study area, comprising 0.2 ha (0.4 ac). Wetland hydrology for this wetland is provided by a nearby stream.

D.1.6 Unconsolidated Shore

Within the study area, unconsolidated shore areas represent areas that have (1) unconsolidated substrates with less than 75 percent aerial cover of stones, boulder, or bedrock, and (2) less than 30 percent aerial cover of vegetation, other than pioneering plants. This is primarily an aquatic habitat but is included here because a small amount of vegetation may be present when water levels are low. This habitat is found along the fringe of depressional open water and/or lacustrine systems. There are 39 ha (96 ac) of unconsolidated shore in the study area.

D.1.7 Open Water

Open water includes areas of surface water where the depth to bottom is unknown or there is standing water with no emergent vegetation present. These areas are less than 8.2 ha (20 ac) in size. This is an aquatic habitat but is included here because submerged aquatic vegetation may be present. These areas sometimes become dry during the summer, which allows emergent vegetation to grow for a short period. There are 52 ha (128 ac) of open water in the study area, most of which is associated with the lacustrine fringe of Great Salt Lake.

D.2 Wetland Functions

D.2.1 Wetlands Functional Assessment

As presented in the Final EIS, the wetlands functional assessment for the Legacy Parkway wetlands was a modification of the hydrogeomorphic (HGM) method for evaluating wetland functions initially developed by the Corps (Brinson 1993). The HGM method categorizes wetlands by their water sources, hydrodynamics, and geomorphic setting, and then evaluates wetland functions based on physical and biological attributes.

Under the HGM method, wetland functions are assessed by comparing the wetlands under investigation with a set of reference wetlands (Brinson and Rheinhardt 1996). Reference wetlands are sites within a specified geographic region chosen to encompass the range of variation within a group or class of wetlands. The sites with the highest level of wetland function are selected as the reference standards. Based on these reference wetlands, regional guidebooks are created, which provide protocols for collecting data and scaling the variables and mathematical models for determining numerical ratings for each wetland function.

No regional guidebooks have been created yet for wetlands in the Legacy Parkway study area. However, an interdisciplinary assessment team (A-Team) was developing draft regional HGM models for the State of Utah at the time the Final EIS was published. The A-Team developed low-resolution wetlands assessment models for the Legacy Parkway project. Low-resolution models require few variables and rely on indirect measures and indicators, which makes them more efficient, quicker, and less expensive to prepare than higher resolution models but somewhat reduces their accuracy and precision (Smith and Wakely 2001). At the time this Supplemental EIS was prepared, the state regional HGM model was not complete enough to offer the accuracy or precision needed to update the HGM model information presented in the Final EIS. As a result, the updated wetlands functional assessment analysis presented in this document continues to be based on the wetlands functional assessment conducted for the Final EIS. Information on this model is summarized below.

Application of Hydrogeomorphic Method

The variables used for the Legacy Parkway wetlands assessment were based on indicators that correlate with wetland functions rather than measured wetland characteristics. The indicators were based on land use within and adjacent to the wetlands and on the presence of roads and other barriers; this information was determined from aerial photographs and field observations. Under the HGM approach, land use in the wetland watershed is an important variable in many wetland function indices. Because the wetland watershed is not always easily determined, some models use the adjacent land within a specific distance of the wetland as a surrogate for the watershed. For the Legacy Parkway project, adjacent land was defined as the land within 305 m (1,000 ft) of the wetland perimeter (see Section D.3 below for discussion of the 305-m [1,000-ft] distance).

The wetland function indicators were assigned numerical values using best professional judgment guided by data developed for a draft HGM regional guidebook for depressional wetlands in peninsular Florida (Trott et al. 1997). Although regional guidebooks are developed for specific regions and wetland classes (Clairain 2002), the A-Team judged that, based on the low resolution of the wetlands assessment models, the numerical values from the Florida model would be similar to those that would be expected for depressional wetlands in the Legacy Parkway study area. Also, broad wetland classes were used rather than the more specific wetland cover types because the models were too general to capture the differences between cover types.

Study area wetlands judged to have the highest level of wetland function were selected as the reference standards against which all wetland indicators were scaled. Under the HGM approach, reference standards are based on wetlands that have not been subject to long-term anthropogenic disturbance (Smith et al. 1995). However, because wetlands in the Legacy Parkway study area have been subject to long-term disturbance, selection of reference standards was limited to available wetlands (Findlay et al. 2002).

For each wetland in the study area, indicators were assigned and then entered into the models to calculate a functional capacity index (FCI) for five wetland functions. An FCI is a numerical estimate of the ability of a wetland to carry out a specific function. The FCI is not an assessment of the actual level at which the wetland performs the function but an assessment of the relative level of function compared to the reference standards. The FCI is scaled from 0 (no function) to 1 (highest function). Wetland functions were quantified as functional capacity units (FCUs), a measure that incorporates both the size of a wetland and its ability to carry out wetland functions. The FCUs for each wetland function were calculated by multiplying the area of each wetland by each FCI.

In June 2000, the Corps approved the results of the wetlands functional assessment. A discussion of the development and use of indicators and models for the wetlands functional assessment is presented in the *Legacy Parkway Wetland Final HGM Technical Report* (Baseline Data Inc. 2000) and in Appendix B2 of the Final EIS.

D.2.2 Wetland Functions

For this Supplemental EIS, the lead agencies reviewed the wetlands functional assessment conducted for the Final EIS and all available information pertinent to the nature and function of the wetlands in the study area. This section summarizes information from the Final EIS and provides, as appropriate, general information clarifying the particular functions being described. As described in Section 4.12, *Wetlands*, the Final EIS based all discussion of wetland functions on the three HGM wetland classes listed above (depressional, slope, and lacustrine fringe). The wetland functions were separated according to wetland cover types to provide additional ecological context by which to interpret the analysis.

Wetlands in the study area perform functions in the following three basic categories.

- Hydrology.
- Biogeochemistry.
- Flora and fauna habitat support.

Each of these categories includes specific functions, which are described below. Table D-2, which updates Table 3-29 in the Final EIS, lists specific functions that wetlands perform in the study area and shows how these functions pertain to the three HGM wetland classes. It was not feasible to assess all possible functions that wetlands perform in the study area. Therefore, the analysis in the Final EIS and in this document focuses on those functions that directly or indirectly affect the ecosystem. Other functions, such as the visual enjoyment and recreational value of wetlands are not discussed in this section.

Table D-2 Wetland Functions

Function	Groundwater Slope	Depressional	Lacustrine Fringe
Hydrology			
Surface Water Detention and Storage	−	+	+
Maintain Wetland Hydrology	+	+	+
Energy Dissipation	−	−	+
Biogeochemistry			
Particulate Retention	−	+	−
Elements/Compounds Retention, Conversion, and Release	+	+	+
Net Organic Compound Accumulation and Element Cycling	+	+	+
Organic Carbon Export	+	−	+
Flora and Fauna Habitat Support			
Maintain Characteristic Vegetation	+	+	+
Maintain Characteristic Invertebrate Food Webs	+	+	+
Maintain Characteristic Vertebrate Habitats	+	+	+
Maintain Landscape-Scale Biodiversity	+	+	+
Maintain Habitat Interspersion and Connectivity	+	+	+

Notes:
+ carries out function
− does not carry out function to a substantial degree

Table D-3 lists the wetland functional capacity units for each HGM wetland class and cover type under existing conditions according to five different functions.

- Function 1: Wetland hydrology maintenance.
- Function 2: Dissolved elements and compounds removal.
- Function 3: Particulate retention.
- Function 4: Habitat structure.
- Function 5: Habitat connectivity, fragmentation, and patchiness.

The FCUs in Table D-3 are numerical representations of the capacity for wetlands in the study area to carry out wetland functions. FCUs provide little information, however, about how wetlands in the study area may function. Therefore, general information describing the five functions listed above and in Table D-3 is presented in the following sections.

This table provides the information on FCUs in this format for convenience only. Because functional capacity measures the degree to which a wetland performs a specific function, the functional capacities of different wetland functions are not equivalent or additive (Smith et al. 1995). FCUs do not represent a "common currency" that can be used to compare functions and impacts between different wetland categories or wetland types (Smith et al. 1995, Brinson and Rheinhardt 1996).

Table D-3 Wetlands Functional Capacity Units—Existing Conditions

		Functional Capacity Units				
HGM Wetland Class	Wetland Cover Type	Function 1	Function 2	Function 3	Function 4	Function 5
Depressional	Forested Wetland	0	0	0	0	0
Groundwater Slope		0	0	0	0	0
Lacustrine Fringe		0	0	0	0	0
Depressional	Shrub-Scrub	0	0	0	0	0
Groundwater Slope		0	0	0	0	0
Lacustrine Fringe		3	3	3	2	2
Depressional	Marsh	24	25	27	18	22
Groundwater Slope		56	59	55	62	57
Lacustrine Fringe		410	516	410	345	355
Depressional	Wet Meadow	217	203	229	154	188
Groundwater Slope		302	253	277	279	283
Lacustrine Fringe		236	283	236	199	204
Depressional	Playa	87	85	95	66	75
Groundwater Slope		41	32	34	37	39
Lacustrine Fringe		226	231	204	159	183
Depressional	Unconsolidated Shore	0	0	0	0	0
Groundwater Slope		0	0	0	0	0
Lacustrine Fringe		68	83	62	49	53
Depressional	Open Water	4	4	5	3	4

HGM Wetland Class	Wetland Cover Type	Functional Capacity Units				
		Function 1	Function 2	Function 3	Function 4	Function 5
Groundwater Slope		0	0	0	0	0
Lacustrine Fringe		56	93	64	63	57

The occurrence and distribution of wetlands in the study area have been affected by grazing, drainage, irrigation, cropping, and/or urban and industrial development, and wetland functions have been degraded in many of the wetlands. The capacity of these wetlands to carry out wetland functions varies greatly, depending on the land use and proximity to existing large wetland complexes associated with Great Salt Lake, FBWMA, duck clubs, and other naturally occurring wetlands. The majority of wetlands found in agricultural areas are grazed and/or cropped. The more intensely these wetlands are subjected to agricultural activities, the lower their ability to perform their natural functions, including wildlife support. The presence of other development also reduces the ability of wetlands to perform their natural functions.

Hydrology

Wetland hydrology comprises “all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface at some time during the growing season” (Environmental Laboratory 1987). Hydrology is regarded as the most important category of wetland functions because wetland hydrology is the basis for all wetland functions. Although not all wetland categories provide the same functions or level of function, wetlands in the study area carry out three general hydrologic functions.

- Short- and long-term surface storage.
- Maintenance of wetland hydrology.
- Dissipation of the energy in moving water.

Depressional wetlands provide both short- and long-term surface water storage. This short-term water storage decreases the amount and velocity of runoff, reducing peak floods and distributing storm flows over longer periods. The stored water provides habitat for aquatic organisms and helps maintain the physical and biogeochemical processes. Water stored in wetland basins percolates into the soil or into the groundwater table, which helps maintain the wetland hydrology of both the depressional wetlands and other adjacent wetlands. The surface water storage function of lacustrine fringe wetlands varies with the rise and fall of the water level in Great Salt Lake. Because they are part of a larger lacustrine system, lacustrine fringe wetlands primarily provide long-term surface water storage. However, when lake levels are low, lacustrine fringe wetlands possessing a basin also provide short-term water storage. Because groundwater slope wetlands lack a basin, they have little or no surface water storage function.

Maintenance of wetland hydrology depends on the ability of wetlands to intercept groundwater and surface water. Groundwater slope wetlands are dependent primarily on groundwater. Groundwater recharge in the study area results from precipitation that percolates into the soil. Processes that either reduce the amount of precipitation, such as drought, or increase the tendency for water to run off rather than percolate lower the groundwater table and adversely affect the ability of wetlands to intercept groundwater. Depressional wetlands depend primarily on surface runoff. The amount of precipitation is important, but processes that reduce the amount of runoff or divert the runoff to other locations also affect the ability of depressional wetlands to intercept surface flows. Lacustrine fringe wetlands are dependent on floodwater from Great Salt Lake, and so maintenance of wetland hydrology is subject to the annual rise and fall of the lake level more than to short-term events. However, during an extended period of drought, when lake levels fall below a level capable of maintaining the wetland hydrology, the ability to intercept groundwater or surface runoff becomes important.

The dissipation of energy in moving water lessens its erosive impact and contributes to reducing downstream particulate loading. This function is provided primarily by vegetated wetlands associated with riverine, lacustrine, and tidal ecosystems. In the study area, lacustrine fringe wetlands vegetated by marsh or wet meadow provide this function, although the ability to carry out this function has been negatively affected by grazing, which removes the vegetation.

Function 1: Wetland Hydrology Maintenance

The FCI for hydrologic functions is an estimate of the ability of the wetlands in the study area to maintain their characteristic wetland hydrology. This function was modeled on two indicators, land use adjacent to the wetlands and the presence of roads and other barriers within the wetlands. Land use affects both the amount of surface runoff that occurs and the amount of groundwater recharge. Decreases or increases in surface runoff attributable to changes in land use can degrade this wetland function. Barriers can prevent the movement of water into, through, or out of a wetland, which can also degrade wetland function by making all or part of the wetland drier or wetter.

In the study area, highly functional wetlands are surrounded by ungrazed rangeland, which has low runoff potential. Other land uses with low runoff potential, such as field crops or improved pasture with rotational grazing, are not expected to substantially alter the amount of surface runoff or groundwater recharge. In contrast, paved roadways and developed areas have high runoff potential, which have adverse effects on both surface runoff and groundwater recharge. Increased runoff adversely affects slope wetlands because it decreases groundwater recharge. In contrast, increased runoff may increase the depth or duration of inundation in depressional wetlands, altering the characteristic vegetation.

Highly functional wetlands also have no barriers to prevent groundwater or surface water from moving freely between all portions of the wetlands. Small modifications to the hydrology, such as unpaved roads or utility easements, are expected to lower the hydrologic functions to a moderate level, whereas extreme modifications, such as four-lane paved roads, large dikes, or large drainage channels, are expected to reduce the hydrologic functions to a low level.

The FCUs that represent how wetlands in the study area maintain wetland hydrology under existing conditions are provided above in Table D-2, and the functional ratings are shown in Figure 3-24a of the Final EIS.

Biogeochemistry

The biogeochemistry function addresses the ability of wetland ecosystems to transport and transform chemicals. Wetlands remove dissolved substances from water through various mechanisms such as absorption, adsorption, solubilization, oxidation, biological transformation, and precipitation. Wetlands, by definition, are vegetated, and it is the vegetation that is responsible for a wide range of physical and biochemical processes. Vegetation slows the velocity of water, reducing the ability to hold particles in suspension. Growing vegetation removes dissolved nutrients and compounds from the water and soil, often metabolizing them and sometimes sequestering them within plant tissues. Bacteria growing in the soil or in plant roots also break down or alter these substances so that they are removed from the water, either by plants or as a gas. The nutrients and carbon fixed by the plants are cycled through the wetlands when the plants are eaten by herbivores or when the plants die and decompose. The flow of water through wetlands provides for the efficient movement and distribution of nutrients and energy throughout the entire ecosystem.

Watershed basins that have more wetlands tend to have lower specific conductance (a measure of the total concentration of dissolved substances) and lower concentrations of chloride, lead, inorganic nitrogen, suspended solids, and total and dissolved phosphorus than do watershed basins with fewer wetlands. Also, certain wetland vegetation is adept at removing heavy metals. Wetlands, therefore, improve water quality by removing both dissolved substances and suspended particulates. Two FCIs were generated for biogeochemical functions, one for removal of dissolved elements and compounds, and one for particulate retention.

Function 2: Dissolved Elements and Compounds Removal

The FCI for removal of dissolved elements and compounds is an estimate of the ability of a wetland to removed dissolved substances from water. This function was modeled on two indicators, land use within the wetland and land use adjacent to the wetland. An individual wetland can process only a finite amount of dissolved elements and compounds before the functional capacity is degraded. Existing land use affects both the type and amount of dissolved elements and compounds released into wetlands, and land uses that increase the amount of dissolved elements and compounds are expected to adversely affect wetland function.

In the study area, highly functional wetlands are unaltered and ungrazed. Grazed wetlands have reduced functional capacity due to increased nutrient loading from animal waste and soil disturbance. Farmed wetlands have increased loading of dissolved substances due to use of farm chemicals and from soil disturbance. Both of these activities also change or remove the vegetation, which reduces the wetlands' ability to remove dissolved substances.

In the study area, highly functional wetlands are also surrounded by ungrazed rangeland. As land becomes developed or placed into agriculture, the amount of dissolved materials increases, as does the amount of runoff conveying the dissolved materials. Therefore, wetlands with a greater proportion of the surrounding land under development or agriculture are expected to have a correspondingly lower ability to remove dissolved substances. Different land use types have varying degrees of impact on this functional indicator; for example agriculture and low density development are expected have less effect than high density development or highways.

The FCUs for removal of dissolved elements and compounds by wetlands in the study area under existing conditions are provided in Table D-3, and the functional ratings are shown in Figure 3-24b in the Final EIS.

Function 3: Particulate Retention

The FCI for particulate retention is an estimate of the ability of a wetland to remove particulates from the water column. The presence of vegetation is critical to this function, since it is the reduction in water flow velocity that causes particulates to drop out of suspension. By removing particulates from surface water flows, wetlands function as filters that improve water quality.

Wetlands generally have limited capacity to remove sediments. Unless inflow of particulates, such as sediment, is balanced by outflow, a wetland will eventually lose all wetland functions, including the ability to retain particulates,. and become upland. As a result, for this function to be sustainable, a wetland must function in a way that slows the movement of particles through the ecosystem, changing a pulse of particulates (such as follows a rain storm) to a lower level of particulates released gradually over a longer period of time. In the study area, this function is carried out primarily in marsh and wet meadow in groundwater slope wetlands. Other wetland cover types are less able to carry out this function. Playa wetlands have low vegetation cover and do not have much capacity to carry out this function. In depressional wetlands, water flow is primarily one-way, flowing into the wetland. As a result, they can continue to function as wetlands only under very low levels of particulate inflow.

The models for depressional wetlands and groundwater slope wetlands used two indicators, land use adjacent to the wetland and the presence of roads and other barriers within the wetland. For lacustrine fringe wetlands, where water flows both into and out of the wetland, this function was modeled on three indicators, land use within the wetland, land use adjacent to the wetland, and the presence of roads and other barriers within the wetlands.

Existing land use affects both the type and amount of particulates released into wetlands, and land uses that increase or decrease the amount of particulates are expected to adversely affect wetland function. In the study area, highly functional wetlands are surrounded by ungrazed rangeland. As land becomes developed or placed into agriculture, the amount of particulates suspended in runoff increases, as does the amount of runoff conveying the particulates. Therefore, wetlands with a greater proportion of the surrounding land under development or agriculture are expected to have a correspondingly lower ability to remove particulates. Different land use types have varying degrees of impact on this functional indicator; for example, agriculture and residential development are expected to have less effect than commercial or industrial development.

In the study area, highly functional wetlands are unaltered and ungrazed. Grazed and farmed wetlands have increased loading of particulates due to soil disturbance and vegetation removal. Soil disturbance, in conjunction with vegetation removal, increases the potential for particulate export and erosion. Similarly, in the study area, highly functional wetlands lack internal barriers to water flow. The presence of barriers within a wetland affects the ability for particulates to circulate within a wetland. For example, a barrier within a wetland may cause part of the wetland to infill, and part to erode.

The FCUs for particulate retention by wetlands in the study area under existing conditions are provided in Table D-3, and the functional ratings are shown in Figure 3-24b in the Final EIS.

Flora and Fauna Habitat Support

Wetlands within the Legacy Parkway study area are located along the eastern edge of the GSLE (See Section 4.0.2, *Great Salt Lake Ecosystem*). This ecosystem is noteworthy because it is the largest inland saline lake in the nation. The wetlands around Great Salt Lake support millions of animals, including more than 250 species of birds, 64 species of mammals, 16 species of reptiles and amphibians, 23 species or subspecies of fish, and a host of diverse invertebrates including flies, mosquitoes, and brine shrimp. Great Salt Lake wetlands are a funneling point for migratory birds using the western half of the continent. Wetlands of Great Salt Lake have been identified in the Western Hemisphere Shorebird Reserve Network as a migratory habitat of hemispheric significance. These wetlands provide not only resting and staging areas for migratory birds, but also breeding and nesting areas for many waterfowl, shorebirds, and amphibians that stay in the area. Section 4.13, *Wildlife,* provides a more detailed discussion of wildlife habitat in the study area.

Wetlands are productive environments that provide diversity in the landscape. The flux of nutrients and energy in wetlands is relatively high because of the high growth rate and rapid turnover of the wetland vegetation. Nutrients and compounds in wetlands are broken down into organic compounds by bacterial action, which provides food for invertebrates. These invertebrates are the foundation of the food web that supports vast and varied numbers of wildlife species, from shorebirds to amphibians. Wetlands provide habitat where many plants and animals can fulfill one or more life cycle stages.

The ecotone along the eastern shore of Great Salt Lake is a mosaic of slope and depressional wetlands and upland habitats. This ecotone provides a large number of niches and habitats for organisms. These characteristics allow wetlands in the study area to provide a diverse array of trophic levels (i.e., feeding levels) within both the wetland and surrounding upland environments. Many species utilize the wetlands for feeding and uplands for nesting. The wetlands are also important to wildlife by virtue of their abundance and the combined functions they serve. Small isolated wetlands also provide value to different species during certain times of the year, such as resting places for migratory shorebirds and waterfowl. Connectivity between the wetlands and surrounding uplands is an important component of the habitat support function of wetlands.

Two FCIs were generated for flora and fauna habitat support functions, one for habitat structure and one for habitat connectivity, fragmentation, and patchiness. The models do not assess the extent to which the wetlands provide habitat or whether the habitat is even utilized by wildlife. Instead, the ability of wetlands to provide habitat for wildlife is assumed, and the models are intended solely to assess the quality of wetland habitat support that presently exists and to evaluate changes over time that can be predicted from landscape-level changes.

Function 4: Habitat Structure

The FCI for habitat structure is an estimate of the ability of a wetland to maintain characteristic vegetation, invertebrate food webs, and vertebrate habitat. This function was modeled on two indicators, land use within the wetland and land use within the adjacent habitat. The more intensely land use disturbs the landscape, the more the characteristic vegetation can change. In the study area, wetlands that provide the highest level of habitat structure are unaltered and ungrazed. With disturbance from grazing, plowing, or grading, the characteristic vegetation can also be susceptible to invasive species (both native and exotic). When wetlands are farmed or overgrazed so that the existing wetland vegetation is removed from the soil surface, wildlife usage changes. Habitat for some species is diminished because there is insufficient vegetation to provide food, shelter or nesting opportunities. However, in some instances, the removal of vegetation results in open areas used by certain shore birds that frequent Great Salt Lake.

Many of the wetlands in the study area are surrounded by ungrazed rangeland. Life cycles of many wildlife species require both wetlands and uplands for feeding, loafing, nesting, and reproduction. Most of the species that utilize both wetlands and adjacent upland habitats fulfill much of their life cycles within 300 meters (1,000 feet) of the wetland perimeter. Changing land uses adjacent to wetlands alters their function as upland habitat.

The FCUs for habitat structure by wetlands in the study area under existing conditions are provided in Table D-3, and the functional ratings are shown in Figure 3-24c in the Final EIS.

Function 5: Habitat Connectivity, Fragmentation, and Patchiness

The FCI for habitat connectivity, fragmentation, and patchiness is an estimate of the capability for wildlife movement within a wetland, and between the wetland and adjacent upland habitat. This function was modeled on four indicators, the presence of roads and other barriers within the wetland, land use adjacent to the wetland, the ability of the study area wetlands to maintain their characteristic wetland hydrology (Function 1), and land use within the wetland.

Wetlands in the study area that provide the highest level of capability for wildlife movement within a wetland, and between the wetland and adjacent upland habitat, are unaltered, ungrazed, and surrounded by ungrazed rangeland. Barriers between the wetlands and the adjacent uplands prevent some species from moving into or out of the wetlands, making them unable to reproduce or compete their life cycle. Animal species such as large mammals, birds, fish and flying insects are less affected by these barriers. Changing land uses adjacent to wetlands, in addition to altering their function as upland habitat, limit the ability of wildlife to move throughout that habitat. Maintaining the characteristic wetland hydrology is important to this function because many of the wetlands in the study area are part of larger wetland complexes that have hydrologic connections. Altering the wetland hydrology of part of a wetland complex may create a barrier that prevents some species from moving between the wetlands. Changing land uses within wetlands, in addition to altering their function as wetland habitat, limits the ability of wildlife to move throughout that habitat.

The FCUs for habitat connectivity, fragmentation, and patchiness by wetlands in the study area under existing conditions are provided in Table D-3, and the functional ratings are shown in Figure 3-24c in the Final EIS.

D.3 Environmental Consequences

As described in the Final EIS, all the build alternatives would affect wetland resources in the study area. Two categories of wetland impacts would take place, direct and indirect, characterized according to which wetland functions are being affected. The Final EIS based all discussion of wetland impacts on the three HGM wetland classes described in Section 4.12.2.1. This section separates wetland impacts according to wetland cover types to provide additional ecological context by which to interpret the analysis.

D.3.1 Direct Impacts

For the initial impact analysis calculations made for the Final EIS, it was assumed that direct impacts associated with the build alternatives would be limited to the area within the proposed action right-of-way and that all the area within the project right-of-way would be directly affected. The impact analysis was carried out by assuming that all wetlands within the project right-of-way would be filled, based on the preliminary design. A separate analysis was carried out for each proposed build alternative.

Fifty-eight wetlands were entirely or partially filled by the initial clearing and grading for the Legacy Parkway or by Legacy-related construction activities associated with the I-15/US-89 interchange in Farmington; the total extent of project-related fill was 19.4 ha (47.9 ac). Five other wetlands were partially filled by construction of temporary access roads in the Legacy Nature Preserve; the total extent of project-related fill in the Preserve was 0.1 ha (0.3 ac). Because these wetlands were filled in conjunction with the Legacy Parkway project, their condition prior to the construction activities was used for assessing baseline conditions.

Table D-4, which updates Table 4-20 in the Final EIS, summarizes the potential direct impacts in terms of the total area affected by each proposed build alternative. Figures 4-14a through 4-14d in the Final EIS show the wetland polygons that would be directly affected by the right-of-way of each build alternative, assuming a 100-m (328-ft) right-of-way.

Table D-4 Direct Impacts on Wetlands by Wetland Class and Wetland Cover Type (for 100-m [328-ft] Right-of-Way

		Area in Hectares (Acres)							
Wetland Class	Wetland Cover Type	Alternative A		Alternative B		Alternative C		Alternative D	
Depressional	Forested Wetland	0	(0)	0	(0)	0	(0)	0	(0)
Groundwater Slope		0	(0)	0	(0)	0	(0)	0	(0)
Lacustrine Fringe		0	(0)	0	(0)	0	(0)	0	(0)
Depressional	Shrub-Scrub	0	(0)	0	(0)	0	(0)	0	(0)
Groundwater Slope		0	(0)	0	(0)	0	(0)	0	(0)
Lacustrine Fringe		0	(0)	1	(3)	0	(0)	0	(0)
Depressional	Marsh	1	(2)	2	(4)	1	(2)	1	(3)
Groundwater Slope		1	(2)	4	(10)	1	(4)	1	(3)
Lacustrine Fringe		8	(19)	16	(38)	7	(17)	7	(18)
Depressional	Wet Meadow	17	(43)	15	(38)	17	(42)	17	(42)
Groundwater Slope		8	(19)	11	(26)	7	(16)	6	(14)
Lacustrine Fringe		4	(9)	7	(16)	9	(23)	4	(9)
Depressional	Playa	2	(5)	4	(10)	6	(14)	5	(12)
Groundwater Slope		0	(0)	2	(5)	1	(4)	1	(2)
Lacustrine Fringe		1	(2)	2	(5)	6	(14)	2	(4)
Depressional	Unconsolidated Shore	0	(0)	0	(0)	0	(0)	0	(0)
Groundwater Slope		0	(0)	0	(0)	0	(0)	0	(0)
Lacustrine Fringe		0	(0)	6	(15)	5	(13)	0	(0)
Depressional	Open Water	0	(0)	0	(0)	0	(0)	0	(0)
Groundwater Slope		0	(0)	0	(0)	0	(0)	0	(0)
Lacustrine Fringe		3	(7)	7	(16)	0	(0)	3	(7)
Totals*		44	(108)	76	(187)	60	(148)	46	(114)

Note:
* Includes acreage of wetlands already filled during previous construction activities.

D.3.2 Indirect Impacts

Indirect impacts are impacts that occur later and impacts that could affect the function of wetlands located outside the project footprint. The impact analysis determined the area of indirect effects on wetlands by assuming that all wetlands within 305 m (1,000 ft) of the right-of-way would be indirectly affected by a proposed build alternative. For the Legacy Parkway project, the distance of 305 m (1,000 ft) was selected based on the draft *Peninsular Florida Herbaceous Depressional Wetlands Hydrogeomorphic (HGM) Regional Guidebook* (Trott et al. 1997) and on other studies (Anderson and Ohmart 1986). The severity of each indirect impact would vary according to the type of effect and the distance from the road (Forman et al. 2003). In general, indirect impacts are greatest adjacent to the road and attenuate with distance. Some impacts, such as the effects of dissolved substances and suspended particles, may be manifested primarily within a few tens of meters of the road in uplands but up to 100 to 300 m (328 to 984 ft) in wetlands. Other indirect impacts may extend for thousands of meters, such as the introduction of invasive exotics or effects on wildlife use and movement through the wetland habitat. Although the effects of some indirect impacts may spread well beyond 305 m (1,000 ft), the strength of indirect effects, on average, was assumed to drop to undetectable levels at 305 m (1,000 ft). A separate analysis was carried out for each alternative. Table D-5 summarizes quantitatively the potential indirect impacts in relation to the total area affected under each proposed alternative.

Table D-5 Area of Wetlands Indirectly Affected by Legacy Parkway

		Area in Hectares (Acres)							
Wetland Class	Wetland Cover Type	Alternative A		Alternative B		Alternative C		Alternative D	
Depressional		0	(0)	0	(0)	0	(0)	0	(0)
Groundwater Slope	Forested Wetland	0	(0)	0	(0)	0	(0)	0	(0)
Lacustrine Fringe		0	(0)	0	(0)	0	(0)	0	(0)
Depressional		0	(0)	0	(0)	0	(0)	0	(0)
Groundwater Slope	Shrub-Scrub	0	(0)	0	(0)	0	(0)	0	(0)
Lacustrine Fringe		0	(0)	0	(1)	0	(0)	0	(0)
Depressional		5	(12)	6	(14)	4	(10)	8	(20)
Groundwater Slope	Marsh	14	(34)	13	(31)	14	(35)	13	(33)
Lacustrine Fringe		31	(76)	83	(205)	75	(185)	26	(63)
Depressional		43	(106)	66	(163)	51	(126)	45	(112)
Groundwater Slope	Wet Meadow	45	(112)	78	(193)	61	(150)	45	(111)
Lacustrine Fringe		24	(60)	64	(159)	58	(143)	31	(78)
Depressional		17	(42)	22	(55)	17	(41)	13	(32)
Groundwater Slope	Playa	2	(5)	12	(29)	15	(37)	2	(5)
Lacustrine Fringe		5	(12)	21	(52)	28	(70)	9	(23)

		Area in Hectares (Acres)							
Wetland Class	Wetland Cover Type	Alternative A		Alternative B		Alternative C		Alternative D	
Depressional		0	(0)	0	(0)	0	(0)	0	(0)
Groundwater Slope	Unconsolidated Shore	0	(0)	0	(0)	0	(0)	0	(0)
Lacustrine Fringe		11	(27)	24	(60)	25	(61)	19	(47)
Depressional		1	(3)	2	(5)	1	(3)	1	(3)
Groundwater Slope	Open Water	0	(0)	0	(0)	0	(0)	0	(0)
Lacustrine Fringe		20	(48)	18	(44)	18	(46)	19	(47)
Totals		218	(539)	409	(1011)	367	(907)	233	(575)

D.3.3 Impacts on Wetland Functions

Impacts on wetland functions were quantified using the wetlands functional assessment models developed for the Final EIS (discussed in Section 4.12.1.2). These impacts were determined by using the wetlands functional assessment to calculate the changes in functional capacity index (FCI) for each wetland under both existing and post-build conditions. The change in wetland function was calculated as the difference between pre-build and post-build FCIs. The impact was calculated as the change in wetland function multiplied by the affected area of wetland. All wetland functions would be reduced to zero for wetlands or portions of wetlands that would be directly affected within the right-of-way. For indirect impacts, each wetland function would be reduced in proportion to the distance from the wetland to the right-of-way. This is because the wetlands functional assessment was based on land use change in the area adjacent to the wetland, and the closer the wetland is to the right-of-way, the greater the area that would be affected.

Because wetlands in the study area are connected hydrologically and are functionally integrated as part of a larger wetland ecosystem, adverse effects on one part of a wetland are expected to spread throughout each wetland complex. The wetlands functional assessment models, therefore, determined the change in each function for an entire wetland. Because the indirect impacts were assumed to drop to undetectable levels at 305 m (1,000 ft), only the area within 305 m (1,000 ft) of the right-of-way was included in the impact calculation. The indirect impact was calculated as the change in wetland function multiplied by the area of the wetland within 305 m (1,000 ft) of the project right-of-way.

Impacts on wetland functions were prepared for each wetland category and each wetland cover type and are summarized below by alternative. Tables D-6 to D-10, which update and supplement Tables 4-20 and 4-22 in the Final EIS, present these impacts quantitatively by wetland function. As noted in Section D.2.2, the information on indirect impacts is presented in this format for convenience only. The functional capacities of different wetland functions are not equivalent or additive.

It should be noted that the wetlands functional assessment models did not incorporate proposed measures for project design features to minimize or avoid project impacts, such as placement of culverts to allow surface flows between the east and west sides of the proposed highway. Because the location and efficacy of these features are not known, the models could not account for any reduction in the expected adverse project effects. Therefore, the results of the wetlands functional assessment represent a worst-case scenario. Additional details of the wetlands functional assessment are presented in the *Legacy Parkway Wetland Final HGM Technical Report* (Baseline Data Inc. 2000) and in Appendix B2 of the Legacy Parkway Final EIS.

Table D-6 Impacts on Function 1—Maintain Wetland Hydrology

		Loss in Functional Capacity Units (FCUs) (Direct/Indirect Impact)			
Wetland Classes	Wetland Cover Type	Alternative A	Alternative B	Alternative C	Alternative D
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Forested Wetland	0/0	0/0	0/0	0/0
Lacustrine Fringe		0/0	0/0	0/0	0/0
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Shrub-Scrub	0/0	0/0	0/0	0/0
Lacustrine Fringe		0/0	2/1	0/0	0/0
Depressional		1/0	3/1	1/0	1/1
Groundwater Slope	Marsh	0/6	6/5	2/5	1/4
Lacustrine Fringe		6/19	23/63	13/54	5/16
Depressional		32/12	29/19	31/11	30/11
Groundwater Slope	Wet Meadow	11/19	19/50	10/28	8/14
Lacustrine Fringe		3/12	12/53	16/37	4/13
Depressional		2/3	8/7	8/4	6/3
Groundwater Slope	Playa	0/1	4/7	3/9	1/1
Lacustrine Fringe		0/2	3/14	10/16	2/3
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Unconsolidated Shore	0/0	0/0	0/0	0/0
Lacustrine Fringe		0/7	13/15	12/23	0/18
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Open Water	0/0	0/0	0/0	0/0
Lacustrine Fringe		2/4	5/4	0/4	2/4

Table D-7 Impacts on Function 2—Removal of Dissolved Elements and Compounds

		Loss in Functional Capacity Units (FCUs) (Direct/Indirect Impact)			
Wetland Class	Wetland Cover Type	Alternative A	Alternative B	Alternative C	Alternative D
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Forested Wetland	0/0	0/0	0/0	0/0
Lacustrine Fringe		0/0	0/0	0/0	0/0
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Shrub-Scrub	0/0	0/0	0/0	0/0
Lacustrine Fringe		0/0	2/0	0/0	0/0
Depressional		2/1	3/1	1/1	2/2
Groundwater Slope	Marsh	1/5	6/5	2/3	2/2
Lacustrine Fringe		11/5	30/28	14/28	10/6
Depressional		28/9	26/3	27/12	30/13
Groundwater Slope	Wet Meadow	11/19	18/39	10/12	8/16
Lacustrine Fringe		6/2	14/17	20/9	4/3
Depressional		3/2	7/1	8/3	6/2
Groundwater Slope	Playa	0/1	3/4	2/5	1/1
Lacustrine Fringe		1/0	4/4	13/2	2/1
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Unconsolidated Shore	0/0	0/0	0/0	0/0
Lacustrine Fringe		0/3	13/7	12/15	0/12
Depressional		0/0	0/-1	0/0	0/0
Groundwater Slope	Open Water	0/0	0/0	0/0	0/0
Lacustrine Fringe		4/0	9/0	0/1	4/0

Table D-8 Impacts on Function 3—Particulate Retention

		Loss in Functional Capacity Units (FCUs) (Direct/Indirect Impact)			
Wetland Class	Wetland Cover Type	Alternative A	Alternative B	Alternative C	Alternative D
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Forested Wetland	0/0	0/0	0/0	0/0
Lacustrine Fringe		0/0	0/0	0/0	0/0
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Shrub-Scrub	0/0	0/0	0/0	0/0
Lacustrine Fringe		0/0	2/0	0/0	0/0
Depressional		1/1	3/0	1/0	1/2
Groundwater Slope	Marsh	0/6	5/4	2/3	1/3
Lacustrine Fringe		8/13	24/47	12/32	7/9
Depressional		31/15	29/6	30/15	30/12
Groundwater Slope	Wet Meadow	10/20	19/43	9/13	8/10
Lacustrine Fringe		4/6	12/36	17/18	5/6
Depressional		2/7	8/4	8/6	6/5
Groundwater Slope	Playa	0/2	3/5	2/4	1/1
Lacustrine Fringe		1/1	3/10	11/7	2/1
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Unconsolidated Shore	0/0	0/0	0/0	0/0
Lacustrine Fringe		0/7	11/10	10/15	0/14
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Open Water	0/0	0/0	0/0	0/0
Lacustrine Fringe		3/0	7/4	0/1	2/0

Table D-9 Impacts on Function 4—Habitat Structure

		Loss in Functional Capacity Units (FCUs) (Direct/Indirect Impact)			
Wetland Class	Wetland Cover Type	Alternative A	Alternative B	Alternative C	Alternative D
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Forested Wetland	0/0	0/0	0/0	0/0
Lacustrine Fringe		0/0	0/0	0/0	0/0
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Shrub-Scrub	0/0	0/0	0/0	0/0
Lacustrine Fringe		0/0	2/0	0/0	0/0
Depressional		1/1	2/1	1/0	1/2
Groundwater Slope	Marsh	1/5	7/5	2/4	2/3
Lacustrine Fringe		8/-1	21/39	9/27	8/8
Depressional		19/6	19/11	19/7	18/7
Groundwater Slope	Wet Meadow	12/15	19/37	11/18	9/10
Lacustrine Fringe		4/-2	10/27	13/17	4/5
Depressional		2/2	5/2	5/2	4/1
Groundwater Slope	Playa	0/1	3/4	3/5	1/1
Lacustrine Fringe		1/-1	3/8	9/8	2/1
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Unconsolidated Shore	0/0	0/0	0/0	0/0
Lacustrine Fringe		0/0	7/12	7/12	0/9
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Open Water	0/0	0/0	0/0	0/0
Lacustrine Fringe		3/-4	7/1	0/1	3/0

Table D-10 Impacts on Function 5—Habitat Connectivity, Fragmentation, and Patchiness

		Loss in Functional Capacity Units (FCUs) (Direct/Indirect Impact)			
Wetland Class	Wetland Cover Type	Alternative A	Alternative B	Alternative C	Alternative D
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Forested Wetland	0/0	0/0	0/0	0/0
Lacustrine Fringe		0/0	0/0	0/0	0/0
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Shrub-Scrub	0/0	0/0	0/0	0/0
Lacustrine Fringe		0/0	2/0	0/0	0/0
Depressional		1/2	2/2	1/0	1/2
Groundwater Slope	Marsh	1/6	6/4	2/5	2/4
Lacustrine Fringe		7/7	20/44	10/29	7/9
Depressional		26/15	24/22	25/15	24/15
Groundwater Slope	Wet Meadow	11/20	19/44	10/34	8/16
Lacustrine Fringe		4/2	10/34	14/23	4/8
Depressional		2/4	6/5	6/3	5/3
Groundwater Slope	Playa	0/1	4/7	3/11	1/1
Lacustrine Fringe		1/0	3/9	9/12	2/2
Depressional		0/0	0/0	0/0	0/0
Groundwater Slope	Unconsolidated Shore	0/0	0/0	0/0	0/0
Lacustrine Fringe		0/3	9/10	8/12	0/12
Depressional		0/0	0/1	0/0	0/0
Groundwater Slope	Open Water	0/0	0/0	0/0	0/0
Lacustrine Fringe		2/-1	6/1	0/2	2/1

D.4 Mitigation Measures

Note: In the Final SEIS, the Wetland Technical Appendix will include a discussion of the adequacy of mitigation measures. This discussion is being developed in consultation with the Corps.

D.4.1 Credit For Preservation

To determine the benefits of preservation on wetland functions, the Final EIS calculated preservation credits for each of the alternative preserve concepts by calculating the difference between FCUs under existing conditions and FCUs under the No-Build Alternative (future 2020 conditions). The future conditions No-Build Alternative described in the Final EIS made the assumption that future development could proceed without filling wetlands, but that there would be a substantial loss of wetland functions resulting from development of adjacent uplands. The wetlands functional assessment models were used to predict the level of loss of wetland functions, based on the assumption that at the current rate of development, all the developable uplands in the study area would be developed by 2020. Under the No-Build Alternative, most wetland functions in the preserve areas would be reduced from 30 to 50 percent by indirect impacts by 2020, even if no wetlands were filled. The prevention of this loss of wetland functions represents the preservation benefit offered by the Legacy Nature Preserve.

In the Final EIS, the number of preservation credits counted for mitigation was discounted by one-half because future development would not be expected to occur all at once and would be spread out between the present and the expected 2020 build-out. The net benefit of preservation would be proportional to the pace of development, i.e., the sooner that development would occur, the greater the benefit would be provided by preservation. Assuming that development would proceed at a linear pace, the benefit at any given time would average one-half that which would be expected if all the development were to occur immediately.

D.4.2 Credit For Restoration

As described in the Final EIS, the wetlands functional assessment models were used to analyze the restoration potential of wetlands in the Preserve. Restoration credits were determined by calculating the difference between FCUs under restored conditions and FCUs under existing conditions. The analysis determined that the amount of restoration possible within the mitigation preserve varied among the build alternatives, ranging from an average increase in wetland function of 34 percent for Alternative B to an average increase of 59 percent for Alternative D. The Final EIS recognized that, because some wetlands in the mitigation preserve were within 305 m (1,000 ft) of Legacy Parkway, there would be indirect impacts from the parkway that would reduce the effectiveness of the mitigation measures. Accordingly, the mitigation credits were debited by the amount of FCUs that would be lost due to the influence of the parkway, as determined from the wetlands functional assessment.